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Advertisement Index, see page xliv. *Official Notices, see Sup. 32.*

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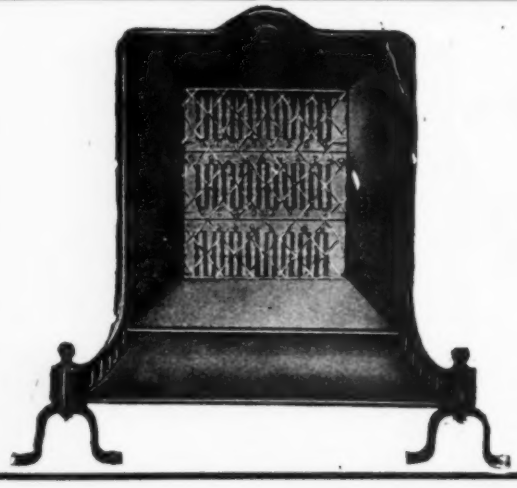

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The

Electrical Review

VOL. XCV. JULY 11, 1924. No. 2,433

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE, M.I.E.E. A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEEKAY, CENT., LONDON," Code, A B C. Telephone Nos.: Central 8200 and 8201.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

LIST OF FOREIGN AGENTS (see first page "Official Notices").

Contents:

	PAGE
Short-wave Radio Telegraphy	45
Wages in the Engineering Trade	46
Business Names	46
The Advertising Convention	46
The L.C.C. Tramways	47
The Transmission Unit in Telephony	47
German Suggestions for Electrical Competition Abroad	47
The Electric Supply Monopoly in Paris	47
The World Power Conference at the British Empire Exhibition (*continued*)	48
The Incorporated Municipal Electrical Association (*illus.*) (*continued*)	52
Electricity in the Home (*illus.*)	54
The National Physical Laboratory	55
Legal	56
Parliamentary	56
Reviews	57
Business Notes	58
Lighting and Power Notes	62
Tramway and Railway Notes	63
Telegraph and Telephone Notes	64
Radio Notes	64
Contracts Open and Closed	64
Forthcoming Events	65
Notes	66
Institution Notes	68
Our Personal Column	68
New Companies Registered	68
Official Returns of Electrical Companies	69
City Notes	69
Stocks and Shares	71
Market Quotations for Chemicals and Metals	72
Switch and Transformer Oil, by C. Sylvester	73
The Tramways and Light Railways Association	74
Some of the Exhibits at Wembley (*illus.*)	76
Electrically-driven Ships' Auxiliaries (*illus.*)	79
London County Council Tramways	80
Trade Statistics of South Africa	81
Turbo-generator Tests at Bristol	82
Correspondence—	
Pulverised Coal	82
Protection Against Pressure Rises	83
Small Power Stations	83
A Critic Comes Home: A Breezy Review	83
The Temperature Rise of Electrical Machinery	83
Specifications for Electrical Plant	84
A Modern Electric Flat	84
Published Specifications	84
Contractors' Column	Advertisement page xxx

Short-wave Radio Telegraphy.

THE lecture which Senator Marconi delivered on Wednesday last week, at the Royal Society of Arts, was the first detailed account of the results which had been obtained from the systematic investigation of short-wave radio telegraphy and telephony. The wave-length used was of the order of 100 metres, with less than 30 kW, and in the spring of last year it was found possible by this means to maintain communication between Poldhu, in Cornwall, and the steam yacht *Elettra* by day over a distance of 1,250 nautical miles, with 12 kW, and for part of the day up to 2,230 nautical miles with 1 kW, whilst the night signals throughout were very strong. Moreover, in the spring of this year signals from this country were received in Australia daily with simple apparatus and on May 30th, 1924, telephony was achieved between Poldhu and Sydney, N.S.W., at the first attempt. Signals were also transmitted to a station near Buenos Ayres, 5,820 nautical miles away, with great regularity and strength, the transmitting station in this case having a directional reflector ½ wave high and 3 waves wide. It is claimed that far higher speeds can be attained, and a greater volume of traffic handled with this system than with the powerful and expensive long-wave stations hitherto employed.

The tendency in recent years has been to employ very long waves for long-distance transmission, but these new results, as Prof. Fleming pointed out in the discussion, were attained by working in exactly the opposite direction. It cannot be doubted that they will exercise a most important influence upon the future of long-distance communication, and great credit is due to Senator Marconi and his assistants, Messrs. C. S. Franklin and G. A. Mathieu, for this notable advance in the art. An abstract of the paper will appear in our next issue.

Some months ago, commenting on the Donald report, we expressed the view that the time had come to make an end of negotiations and proceed at once with the establishment of Imperial wireless communication, even if that meant authorising the Post Office to do it. Since then the Government has decided in favour of the report, allotting Imperial communications to the Post Office and foreign communications to private enterprise, and we may regard the matter as settled—at least, until another set of politicians gains control. Fortunately, it is said that the Marconi company has accepted the situation and is prepared to co-operate with the Government, and that it is probable that agreement with the Dominion Governments will soon be reached. We trust, therefore, that the fear which we expressed lest further delays should result from the introduction of the short-wave system will prove groundless, and that an Imperial service will be instituted as quickly as possible—no matter what system be adopted.

It appears that long-distance, short-wave telegraphic transmission with one kilowatt was proved efficient over a year ago, and that "the practical range of the system, when using 12 kilowatts, had not even been approached." Short-wave transmission *per se*, of course, cannot be patented. Presumably, if the Post Office was aware of the results obtained last year, it did not attach much weight to them, although the fact that for long-wave transmission very costly transmitting stations were necessary was a powerful argument against State ownership. However, it did not prevail with the Donald Committee.

Wages in the Engineering Trade.

On Wednesday next, July 16th, the conference between the employers and employed in the engineering industry will be resumed in London. The two parties have met on several occasions and spent many hours together. The proceedings have been conducted in private, but the officially-issued report of the speeches made at the first conference by Sir Allan Smith and others regarding the difficulties with which the industry was faced, as well as the much briefer statements that have followed the later sittings, show that the delegates have had plenty of information put before them and have had opportunities for asking for anything more that they considered essential to a right understanding of the position. From what has been published regarding last week's meeting between the Engineering and Allied Employers' Federation and the full executives of the unions (the *Daily Telegraph* Labour correspondent says that the representation on the workers' side rather assumed the dimensions of a public meeting than a round-table conference), we gather that Sir Allan Smith amplified his May statement by quoting statistics regarding the business of a number of engineering firms. He appealed for an attempt to be made to get rid of the prevailing unsettlement of the industry and to establish stability; Mr. Brownlie is reported to have pressed the employers to make a definite offer; and some union delegates assert that there is no likelihood of stabilisation until the question of wages is settled. It looks as though the two sides have now argued the matter to the full, and the conference stands adjourned until July 16th, when the Employers' Federation will report the result of consultation which is taking place with its constituents in various districts.

No doubt sooner or later a full report of these negotiations or conferences will be issued. At any rate we hope so, for such action will be evidence of sincerity on both sides and of a genuine desire that the public shall be in a position to have a full understanding of the case. The proceedings should be of service to those to whom it falls to make the promised Government Inquiry into Export Trade, for the burden of heavy local rates and national taxation, the high cost of transport, the high cost of living, as affecting the cost of engineering production, as well as the questions of Imperial Preference and Tariffs, have all come under review.

Business Names.

During the war it became more necessary than it had been regarded previously, to know the names of individuals linked together in a business partnership. Many of the revelations which were made during the years 1914 to 1918 rendered legislative measures imperative which would not or might not have been passed under other conditions. Most of the special war-time enactments fell out of the Statute Books when the emergency period had passed, but there were certain of them which possessed merit for other times, enabling the business world to profit from lessons learned in a period of strain, pressure, and traitorous conduct. One such measure was the Registration of Business Names Act, one of the requirements of which was for the names and nationalities of partners to appear on letter-headings. Of the wisdom of, and the need for, the measure during the war period there was never any question. It may have disadvantages for the most innocent-minded in times of Peace, and in isolated cases it may even exercise a restraining influence on business enterprises; yet, on the whole, especially when there is a desire to deal first with one's own kith and kin or with one's former allies, the advantage of knowing with whom one is dealing outweighs the disadvantages imposed upon a few. Such information is obtainable regarding a limited company registered at Somerset House, and the Act says that it should be accessible in respect of private businesses. But the merits of the case need not be discussed. What is of greater interest is the fact that the Act is not being complied with, as most business people know who study trade letter-headings. We have referred to the subject on several occasions, but prosecutions are few and far between. The unsatisfactory situation that has thus arisen has been under the consideration of the Federation of British Industries, and that body has communicated with the Board of Trade, pointing out that private firms frequently fail to comply with the terms of the Act and re-affirming its previously expressed view that information respecting the names of partners is of value to the general commercial public.

The Advertising Convention.

The International Advertising Convention which will be held in three sessions at Wembley and at Stationers' Hall on Tuesday and Wednesday next, is one of the most important business events of the year. We have already explained its purpose, and we hope that the interchange of opinions between so many "live wires" of the advertising and industrial world from both sides of the Atlantic will produce the desired results. A number of papers are to be contributed by authorities on matters of interest to traders and the Press, including what is known as the Business or Trade and Technical Press, while there will be many public utility contributions. Amongst these is one by Lieut.-Col. Vignoles, D.S.O., M.I.E.E., of Grimsby, on "Co-operative Advertising of a Public Utility," and one by Mr. Evelyn Boys, M.C., A.C.I.S., Secretary of the North Metropolitan Electric Supply Co., on "The Personal Element in Public Utility Advertising." In quite another class, and perhaps of special interest to publicity men engaged in the drawing-up of advertisement matter for the Trade Press, is a paper by Mr. J. C. McQuiston, manager of the Department of Publicity of the Westinghouse Electric & Manufacturing Co., of America, on "Factors to be Considered in Writing Advertising Copy." When British and American publicity men put their heads together with regard to such a matter they of necessity find that the factors differ on the two sides of the Atlantic, but that circumstance will not lessen the value of an interchange of ideas regarding features that are common to both the British and the American advertising worlds. Not all the advertising genius lies outside the United Kingdom.

The L.C.C. Tramways.

THE deficit of £160,220 upon the working of the L.C.C. tramways during 1923-24, reported by the Highways Committee, is disappointing after the favourable result secured in the previous year. The matter, however, is seen to be less serious when the figures, which are reproduced elsewhere in this issue, are examined. In the first place the loss to the system entailed by the March strike, which lasted ten days, appears by calculation to have been about £24,000. This, however, may have been partly offset by the conditions prevailing during the railway strike. The capital charges were some £64,000 higher, and, in addition to these, the controversial "road maintenance" item has to be taken into account, "the saving to the road authorities . . . was estimated . . . to be about £255,000 a year." Debt redemption was proceeded with to the extent of £399,000, leaving a little more than half of the large capital expenditure unredeemed. Renewals charged to revenue accounted for over £330,000.

From these figures it will be gauged that there is little wrong with the undertaking; in view of its magnitude and its sound financial position, the so-called "deficit" possesses little significance.

The Transmission Unit in Telephony.

IN the early days of electrical engineering, the unit of resistance commonly adopted was a length of wire, such as Varley's unit—one mile of copper wire 1/16 inch in diameter; as precision of measurement increased and theory developed, such units were ultimately replaced by the "absolute" ohm, which in practice, however, is still represented by the resistance of a column of mercury of a certain length and mass. Varley's unit had a value of about 25 ohms. In telephony, to this day, the unit by which the efficiency of speech transmission is measured is like Varley's, of a purely arbitrary nature—the "mile of standard cable"; but the method of its use is very different, it being in fact a logarithmic function of the ratio of the "sound power" output to the "sound power" input.

The "mile of standard cable" has not been altogether satisfactory as a unit, and recently it has been replaced in the "Bell" system, U.S.A., by a new "transmission unit," so chosen that two amounts of power differ by one "transmission unit" when they are in the ratio of $10^{0.1}$, and any two amounts of power differ by n units when they are in the ratio of $10^{n(0.1)}$. The number of transmission units corresponding to the ratio of any two powers P_1 and P_2 is then the common logarithm of the ratio P_1/P_2 divided by 0.1, or $n = 10 \log_{10} P_1/P_2$. Since n is a logarithmic function of the power ratio, any two numbers of units, n_1 and n_2, corresponding respectively to two ratios, P_a/P_b and P_c/P_d, may be added and the result $n_1 + n_2$ will correspond to the product of the two ratios.

The reasons for the selection of this unit, and the method of applying it, were set forth in a short paper presented to the American Institute of Electrical Engineers, by Mr. W. H. Martin, of the American Telegraph and Telephone Co., at the Annual Convention at Chicago, last month.

After outlining the theory of the "standard reference circuit," the author pointed out that the mile of standard cable corresponded not only to a certain change of volume but also to a change due to distortion of the reproduced speech sounds, which was a desirable quality when commercial circuits had distortion comparable to that of standard cable. However, many types of circuits were now being used which had much less distortion, and voice testing had been replaced by tests with currents at known frequencies; hence a unit which was distortionless—*i.e.*, not a function of frequency—was desirable. The unit chosen is logarithmic, distortionless, based on a power ratio, with which it has a simple relationship, and its effect on the transmission of telephonic power is approximately the same as that of one mile of standard cable (6 per cent. less); the number of units corresponding to any power ratio, or current ratio, can be determined from a table of common logarithms.

A distortionless telephone circuit is also being constructed, consisting of a transmitter, a line, and a receiver, and it is proposed that it shall be adopted as a transmission reference system for telephone work.

German Suggestions for Electrical Competition Abroad.

THE Central Union of the German Electrotechnical Industry held its annual meeting in Berlin on June 20th, when a report was presented illustrating the crisis through which the industry is now passing. The report was followed by a paper by Dr. Hissink, of the Bergmann Electricity Works Company, dealing with the measures necessary in a technical and commercial sense for the maintenance of the competitive capability of the German electrical industry in the markets of the world. The author stated that wages in the industry reckoned on the basis of the working shift in Germany, were certainly lower than in former peace times, and were lower than those paid abroad. The position was different, however, with regard to efficiency of production. The chief rôle would have to be played by an improvement in the works' equipment and in the method of working, but wages must be paid more according to the working results of labour. Herr Hissink advocated the introduction of production in bulk, but, he said, standardisation had yielded results which could scarcely be regarded as successful; thus standardised electrical articles had turned out excellently from the point of view of materials, but they were unsaleable abroad. It was not necessary systematically to increase the length of the working shift, but the industry required freedom in this matter. The author suggested that there should be a closer connection of works producing the same classes of manufactures—with specialisation and bulk production in the individual works, the establishment of common constructional departments, and common buying-in and sales offices.

The Electric Supply Monopoly in Paris.

THE consumption of electrical energy in Paris under the control of the Compagnie Parisienne de Distribution d'Electricité continues to increase and at a greater rate than the growth in the number of customers. Thus in 1923 the total consumption amounted to 300,948,000 kW-hours in round figures, and represented an advance of 20 per cent. over the previous year, while the number of consumers rose to 379,000 by the end of last year, an increase of only 18 per cent. The lighting load reached 168,000,000 kW-hours in 1923, and the power consumption was 132,000,000 kW-hours. Concerning the programme of extending the generating plant which was settled in 1920, the report of the company states that the increase of 120,000 kW to 240,000 kW is being completed, and the additions will probably be in full operation next winter. The second section of the programme provides for the installation at the Saint-Ouen station of three sets of 30,000-35,000 kW with six boilers, which are now in course of erection. The third section of the scheme comprises the substitution of new plant for the old sets in the stations and sub-stations; this work also is in progress, but the entire replacement will still occupy some years. A further extension has just received official approval; it also concerns the Saint-Ouen station, and consists in the proposed laying down of three new turbo-generator sets of from 30,000 to 35,000 kW and the necessary boilers. The completion of these four extensions will raise the capacity of the works to 450,000 kW. Simultaneously steps have been taken to erect new distributing centres and lay further feeders and mains. The company's concession was extended some time ago by ten years to the middle of 1950, although the Paris City Council has the right of expropriation as from 1935 and in every succeeding period of five years.

The World Power Conference at the British Empire Exhibition.

(Continued from page 4.)

THE actual business proceedings of the World Power Conference opened at the British Empire Exhibition at Wembley on Tuesday, July 1st, the day being devoted to reviews of national power resources; papers on the subject were presented by representatives of no fewer than 28 different countries. Sir John Snell, chairman of the Electricity Commissioners, who presided over the morning session, after referring to the importance of such an international gathering of power production experts, suggested that, while they were engaged in meeting an ever-growing demand for power, they had a duty to posterity to bear in mind—that of utilising all known sources of fuel in the most economical manner so that the period of exhaustion should be delayed to the utmost. There was much still to be done in the way of fuel conservation and economy, for, although an output of 1 kWh per 3 lb. of coal represented progress, by adopting the latest improvements it was possible to reduce coal consumption by one half.

Coal Resources of the World.

Sir Richard Redmayne, K.C.B., gave a summary of his paper on "The Coal Resources of the World." Of the individual countries, the United States took the first place with resources amounting to 5,072,431 million tons. So far as Great Britain was concerned, he regarded 600 years as the country's coal life at the present rate of production. Everything pointed in the United Kingdom to the need for the more economical utilisation of coal. In this connection he considered that while much was known from the geological point of view, there was great need for further research from the chemical aspect. Generally speaking, consumers had little knowledge regarding the relative values of different fuels, and the work which was being done by the Fuel Research Board would be very valuable.

In Sir Richard's opinion, coal should hold the field as the main source of energy, heat, and artificial light, and must do so for many years, a view which was shared, in the subsequent discussion, by Mr. G. Otis Smith, Director of the United States Geological Survey. In fact, Mr. Smith considered that, despite the increasing use of water power in the United States, it was not keeping pace with coal, and as an evidence of progress he mentioned that in five years there had been an increase of 33 per cent. in the efficiency of steam-operated electricity plants.

Australia's Resources.

A voluminous report on The Power Resources of Australia and New Guinea, compiled by the Australian Institution of Engineers under the authority of the Commonwealth Government, was presented by Dr. Russell Sinclair and Mr. W. H. Taylor. Australia was, they stated, well supplied with coal and lignite, it being estimated that there were 30,000 million tons of lignite obtainable by open-cut work. At Morwell, Victoria, a 62,500-kW station had been built to use lignite as fuel. Mr. Taylor mentioned that estimates of the water-power resources of the Commonwealth varied from 625,000 to 1,300,000 h.p. Tasmania had led the way in hydro-electricity development, and although only 10 per cent. of the available power on the island had so far been utilised, it had led to the establishment of important industries. In Western Australia, the State with which he was more intimately concerned, both coal and water power were available, and although the population was but small, the electricity consumption per head was extremely high. One problem they were considering was that of utilising forest refuse, of which they had large quantities. He also alluded to the value of wood gas producers in districts not provided with coal and water power.

Water Power in the United Kingdom.

Prof. A. H. Gibson, in a summary of his paper on "A Review of the Water Power Problem in Great Britain and Ireland," stated that there were no statistics as to the aggregate capacity of the plants at work, but he estimated it at 250,000 h.p. Hitherto such installations had been laid down by private enterprise, and development was rendered difficult owing to the many interests which had to be reconciled. In Great Britain a further 200,000 h.p. and in Ireland—which had little coal—500,000 h.p. might be developed economically. Prof. Gibson concluded with a reference to the Severn tidal-power scheme, and expressed the hope that on the occasion of the next Power Conference in London the delegates would have an opportunity of inspecting a most interesting installation.

Commenting on this paper, Mr. J. Armfield drew attention to the economy of small hydro-electric plants. His experience showed that installations of from 15 to 100 h.p. could be laid down for £20-£40 per h.p., while those of 500 h.p. and over cost £50, and even up to £100 per h.p.

Notable American Hydro-Electric Development.

Mr. O. C. Merrill, Executive Secretary of the United States Federal Power Commission, dealt with American power resources, particularly water power. Notwithstanding that the country consisted of many States, each with its own Government, the Federal Government now had control of over 85 per cent. of the available water power in the United States, and surveys had shown that 50 million h.p. was available. Licences had already been granted in respect of the use of 7½ million h.p., and further plants totalling 2½ million h.p. were under construction. In 1922 the total production of energy in America had amounted to 47,659 million kWh, of which 30,452 millions were generated from fuel and 17,206 millions from water. California had undergone the greatest electrical development, the production *per capita* in that State having advanced from 530 kWh in 1910 to 1,280 kWh in 1923, as against 450 kWh *per capita* for the whole of the United States. Last year the water-power production in California had amounted to 4,120 million kWh, New York State following with 3,561 million kWh.

Canadian Resources—Coal, Water Power, and Oil Shales.

Dealing with Canada, Mr. F. A. Gaby, of the Ontario Hydro-Electric Commission, said that the Dominion was well supplied with both coal and water power. There were, however, large districts not well served, which meant either steam plants or long-distance transmission, the latter being a direction in which Canada occupied a leading position. During the past decade, the use of water power in industry in Canada had increased 245 per cent., as against an advance in population of only 22 per cent. The water power now utilised in the Dominion amounted to 3,227,414 h.p., and, including transmission and distribution, represented a capital investment of 668 million dollars. The total available water power—minimum 24-hour continuous power—in Canada was estimated at over 18 million h.p., equivalent to an ultimate turbine installation of 40 million h.p. Even at the present time, 97.7 per cent. of the total electrical power in the Dominion came from water. The main resources were in Ontario, where the Hydro-Electric Power Commission had generating plant aggregating 801,629 h.p.

Mr. B. F. Haanel, chief engineer of the Fuel Division of the Canadian Department of Mines, dealing with the

fuel resources of Canada, remarked that the Dominion possessed 60 per cent. of the coal of the British Empire, and that it had also enormous deposits of oil shale, which would be of immense value when the sources of mineral oil became exhausted. In his opinion, Canada could be looked upon as the Empire's, if not the world's, storehouse for future supplies of coal and oil derived from coal and shale.

New Zealand's Hydro-Electric Developments.

In the absence, owing to illness, of Mr. Lawrence Birks, chief electrical engineer of the New Zealand Public Works Department, Mr. E. Parry, consulting engineer to the New Zealand High Commissioner, presented an interesting report on the water-power resources of New Zealand, which indicated that the Dominion was taking a very high place in hydro-electric generation and distribution. In the North Island installations of a total capacity of 314,000 h.p., with distribution at 110,000 volts, were in hand, notably at Mangahao and Arapuni. It was, stated Mr. Parry, the object of the Government to provide a supply of electricity to every inhabitant, no matter how remote the district in which he resided.

What India is Doing.

Mr. J. Willoughby Meares, electrical adviser to the Government of India, dealt with the hydro-electric position in that country. The water power already developed or under construction was mainly concentrated near Bombay, the majority of the plants working under heads of nearly 2,000 ft. Although no information could be given as to costs of installation or production, he claimed that the water power undertakings in India were able to supply power more cheaply than any fuel-operated plant in the country.

Mr. Meares drew attention to the varying practice throughout the world as regarded the estimation of water-power resources, capacities, rates of flow, &c., and suggested that there was need for an international system of standards for recording all such factors. Subsequent speakers, both American and foreign, being in accord with Mr. Meares's views, it is possible that one outcome of the Conference will be the establishment of a committee to draw up a series of international water-power standards.

Col. Battye followed with a short account of the hydro-electric work which was being done in the Punjab. Surveys had shown that in the Lower Himalayas alone 10 million h.p. was available. They were adopting the New Zealand idea of providing current for even the smallest and most remote consumer, and in this connection he expressed the opinion that the question of current transmission was much more important than that of generation.

The Unimportance of Power Cost.

Mr. W. S. Murray, of New York, created considerable interest by a statement that in these days of power demand the cost was relatively unimportant, the great thing being the availability of supply. In the total costs of production in many industries, power only entered to the extent of from 4 to 5 per cent. In his opinion, power and transportation were the two main factors to-day, and the relation of one country's development to that of another would depend very largely thereon.

Continental Power Resources.

The afternoon session was devoted to a consideration of the power-resource position of Continental and foreign countries, the various reports presented showing that the war and the resulting high prices of fuel had wrought many changes. Austria, stated Herr Taussig, of Vienna, having lost its main coal resources, had been compelled to turn to water power, of which 200,000 h.p. was now being utilised, with further plants totalling 65,000 h.p. under construction. Belgium, stated M. Uytborck, was well supplied with coal, new discoveries in the North-Eastern province more than compensating for any early exhaustion of the seams in the southern part of the country. As to water power, it was possible that the River Meuse could be utilised to give an output of 160 million kWh per annum. Dr. Zmavc, speaking for Czecho-Slovakia, stated that 1,722,000 h.p. of water power was available in that country, of which only 155,000 h.p. was at present utilised. Big developments were, however, in progress. Mr. Morch, of Copenhagen, gave some information regarding Denmark in connection with the supply of electricity from Sweden by submarine transmission. Prof. F. K. T. van Iterson, on behalf of Holland, stated that the country enjoyed the benefit of cheap coal from England and Germany, so much so that Dutch coal was being exported to countries where better prices could be secured. M. Ir. Wouter Cool remarked that the Dutch East Indies possessed great mineral wealth, and was also developing its water-power resources. Owing, however, to the fact that they had a five months' dry season, a reserve steam plant was a necessity for all hydro-electric installations.

The position in France, both as regarded coal and water power, was dealt with by three speakers—M. Arbelot, M. Guillaume, and M. B. Picard. The first supported the demand for standardisation of water power terms, and recommended that productive capacities should always be given in kW. M. Picard dealt mainly with the position in the coal-mining areas of the Nord and Pas de Calais, where special attention was being devoted to the utilisation of high-percentage ash fuel. In his view there would be in the near future a marked development in the two departments in the establishment of electricity generating and distribution plants at the collieries.

The position in Hungary, which country, as a result of the war, has lost most of its coal and oil resources, was dealt with by Mr. L. de Verebely. Signor Renzo Norsa gave some interesting particulars of the huge hydro-electric development which is taking place in Italy, a country which has only a poor coal supply. Other speakers dealt with Japan, Poland, Spain, Jugo-Slavia, Norway, and Sweden. In the last two countries water power utilisation is highly developed, and big schemes for the co-operative "export" of electric power to Denmark and other countries were stated to be under consideration. Finally, Dr. E. Tissot, president of the Association Suisse des Electriciens, presented a report on Swiss progress, in which he mentioned that 90 per cent. of the houses in Switzerland were now lighted by electricity and that 95 per cent. of the railways were either electrified or in course of electrificaton. Switzerland, he claimed, took the leading place in water power utilisation, notwithstanding that an important problem had been that of arranging water storage for winter power plant requirements.

Economics and Finance.

The proceedings on Wednesday, July 2nd, were devoted to a study of the "Economical and Financial Aspects of Power Resource Utilisation." Presiding at the morning session, Sir Robert Horne, G.B.E., regarded this aspect of the subject of power supply as one of the most important, having regard to the confused condition of many countries as a result of the war. To replace the wealth which had been destroyed, new wealth had to be created, and this could best be done by ample supplies of cheap power. Great Britain possessed vast deposits of coal which, unfortunately, were at the present time egregiously used, the country taking a very poor second place as regarded electric power development to the United States.

Nearly a dozen papers were presented during the day. Mr. David Rushmore, consulting engineer of the General Electric Co., Schenectady, New York, U.S.A., spoke of the necessity for a consideration of the interests of all parties. While it was necessary to give capital an adequate return and a degree of safety and stability, future success could only be achieved by a consideration of the rights of the station employés and also the consumers. Mr. C. Kleman, secretary of the Swedish Water Power Association, explained the system of State control in Sweden, which provided for either competition or co-operation with municipalities

or private enterprise. This had, he stated, proved of advantage to consumers, and there was now no general controversy regarding the question of State or private supply. In anticipation, however, of a time when the rich power districts of the country would be called upon to give a supply to the less fortunate parts of Sweden, schemes for the establishment of main transmission lines by independent enterprises in which the State, the power selling, and the using interests should all be represented were under consideration.

The Economics of World Power.

In a lengthy paper, Sir Philip A. M. Nash discussed the question of the Economics of World Power. As in his opinion the coal resources were sufficient for many centuries, the problem to-day was not that of supply, but that of economical use. Although to come from 10 lb. of coal required to generate 1 kWh ten years ago, down to from 1.78 lb. to 2.28 lb. to-day was a great achievement, it was not enough. The efficiency of conversion from fuel to power was still not more than 22 per cent., and the reduction of the 78 per cent. loss to from 50 to 60 per cent. was the task of the immediate future, inasmuch as it would have an enormous effect on the cost of power and consequently on industrial development generally. Great Britain had much leeway to make up, for while in this country only 3.88 per cent. of the potential power from coal, oil and water power was being used, in America the figure was 8.4 per cent., France 16.7 per cent., Germany 6 per cent., Italy 32.1 per cent., and Switzerland 36.2 per cent. The wealth of a nation might be considered in terms of its resources to yield economically an efficient and abundant supply of power, and although Great Britain was behind, he was glad to be able to report that big developments were on their way.

Financing Electrical Undertakings.

Two papers on the financial aspect of power supply from the banker's point of view were presented. The first was by Sir Ernest Harvey, who held out little prospect for financial assistance to those countries which were only able to offer unstable paper money in return for solid money. In fact, currency depreciation and international financial conditions had had a most adverse effect on the capacity of London to help in the development of cheap and ample supplies of power the demand which, curiously enough, had become more insistent since fuel had become so costly. Sir E. Harvey's message to the representatives from foreign countries was that no help would be forthcoming until more stable currencies had been introduced, for "if bankers put good money in a country, they wanted good money in return." The second paper was by Mr. H. M. Addinsell, of New York, who discussed the question of Government *v.* private ownership of power generating plant. In America, insurance companies were large investors in such undertakings, and the general opinion was that private enterprises were the most efficiently run. He was in favour of Government control so far as the granting of "regulated monopolies" was concerned; otherwise he was an advocate rather of "more business in Government" than "more Government in business."

South African Progress.

Dr. H. J. Van der Bijl, the chairman of the South African Electricity Supply Commission, reporting on the position in the Union, stated that the plan of operations was that of eliminating small power stations and substituting a large regional distributing system, the large generating plants being linked together. From the electrical point of view, South Africa had little water power; on the other hand, it had good coal resources, from which they were producing energy at a cost approaching that of hydro-electric generation.

"Diversity Economy."

Mr. W. S. Murray, one of the American delegates, in a short address, pointed out that true economical electricity supply in the future lay in the direction of a better relative allocation of the power and load centres and of the linking-up of the various generating and distribution systems so as to effect "diversity economy," which he described as (1) the ability to produce the greatest amount of electricity at a minimum monetary cost, and (2) the ability to deliver the output at the different load centres at the lowest possible price. That this was possible of achievement was shown by the present-day ability to produce a single set of 100,000 h.p. and to transmit 500,000 h.p. up to a distance of 500 miles within a reasonable margin of commercial loss.

The Position in Scotland.

Dr. J. F. Crowley submitted a joint paper by himself and Mr. Eric M. Bergstrom on "The National Development of the Water Power Resources of Scotland." The country possessed, he stated, 77 per cent. of the water-power resources of the United Kingdom, and he looked forward to developments not only in the linking-up of steam-operated plants, but to interconnection between these and hydro-electric stations, and with electro-chemical and electrometallurgical works. He agreed with a previous speaker that availability of ample power was of more importance than its cost, and instanced a case of an increased productivity of 10 per cent., which, after making allowances for the cost of the greater output, had resulted in a 30 per cent. increase in profits. Although, however, the statement was true in a general sence, there were industries in which the cost of power figured materially.

Dr. Crowley aroused some interest by stating that although by-product utilisation was extremely necessary from the point of view of fuel conservation, such utilisation was not a paying proposition, and if, from the conservation aspect, by-products were to be utilised, Government encouragement, if not Government subsidy, was necessary. For the improvement of power-station load conditions, they ought to encourage the establishment of important chemical industries and, as an example, he referred to the production by means of off-peak current of electrolytic hydrogen for synthetic ammonia manufacture.

Labour and Electric Power Development.

At the afternoon session, Mr. Fred. M. Low (New York), in a paper on "The Social Aspect of Power Development," drew attention to the value of electricity to modern civilisation, and said that, as it had become vital to human well-being, the people were becoming watchful of any tendency towards monopoly. Thus it was in America that, as regarded the utilisation of water power for electrical purposes, licences were only being given for a period of 50 years, at the end of which the properties could, at the Government's option, revert to the State upon repayment of the net investment therein. The wide scope of the Conference was also exemplified by an address from Mr. Jas. P. Noonan, president of the International Brotherhood of Electrical Workers, in which he stated that the time had long gone by when labour could have any quarrel with the introduction of improvements and labour saving devices. Workers had come to realise that these did not mean less employment, but, on the other hand, more employment and better conditions generally. For the proper development of power resources, he thought the time had arrived not merely for the subject to be dealt with by technical and financial experts, but that the co-operation of labour interests should be sought. So far as American labour was concerned, he was able to say that it was ready and willing to co-operate.

Future Hydro-Electric Progress in Italy.

Signor Guido Semenza, in dealing with Italian progress in water-power development, which, owing to the high cost and scarcity of coal, had been very rapid during the past ten years, stated that much remained to be done; not only would further stations be established, but existing stations would be linked up to provide for excessive peak loads in any particular areas. All the rivers were the property of the State, which granted licences for 30 or 60 years on terms which pro-

vided that, at the end of the licence period, the hydraulic portion of the plants became the property of the Government, which could either then lease it to the supply companies or purchase the electrical installation and run it as a State undertaking. Italy was now able to generate electricity from water at a price equal to the lowest cost in countries favourably situated as regarded coal supplies.

Cultivate the Housewife!

Mr. H. Johansen (Norway) created some amusement by stating that the way to encourage the use of electricity was through the housewives. The greater the use of electricity for domestic purposes, the greater became the demand for power supply.

Mr. D. Rushmore presented a paper on "New Fields for Power Application," by Mr. E. W. Rice, Junr., of the General Electric Co., Schenectady, U.S.A., while Señor Montanes dealt with the position in Spain, paying a tribute to the financial support given by Canada and Great Britain to the water-power development in Catalonia, which had been of immense value to the Barcelona district. Although the present time was not a favourable one, from the financial aspect, there were many opportunities for electric power plant installation in Spain, and as an instance he mentoned that, owing to the present high cost of coal, work at many mines had been entirely suspended. As a matter of fact, the coal and water-power resources of Spain were so located that a main electricity distribution network could be set up right round its coast line, and to this secondary systems could be connected to supply every part of the country. Such a scheme had been considered, but the Government showed some hesitation in taking it in hand itself. Finally, M. Constantin D. Busila gave a short account of the position in Rumania, particularly as to the oil resources of the country and their utilisation in power generation.

Summing up the discussion, M. Arbelot (France), who presided at the afternoon session, agreed with the suggestions that had been put forward that the World Power Conference might well form a branch of the work of the League of Nations, or, failing that, it should be made into a permanent body capable of arriving at conclusions from the international point of view on questions of the control and financing of power supply. It was decided that it was competent for any of the delegates to submit resolutions, and that such resolutions should be voted upon at the final day's sitting of the Conference.

List of Papers.

(*Continued from page 4.*)

Section B.—Water Power Production.

61. The Influence of Large Water Power Installations on the Regime of Flow: Dr. Frederic Schaffernak (Austria).
62. Rivers as Factors of Energy: Ing. Eduard Suess (Austria).
63. Recent Practice in Civil Engineering with Reference to Water Power Production: Oberbaurat Dr. Ing. Karl Innerebner (Austria).
64. Historical Note on the Kaplan Turbine: Dr. Ing. S. Kneidl (Czecho-Slovakia).
65. Water Power Production and Power Transmission in the Dutch East Indies, General Principles, Present Activity, and Future Possibilities: Prof. J. N. Van der Ley (Dutch East Indies).
66. Special Conditions of Civil Engineering Features of Water Power Development in the Dutch East Indies: W. Blaser, M.N.R.I.E. (Dutch East Indies).
67. Energie hydro-électrique: M. Maroger (France).
68. Problems relating to Run-off, Storage, and the Allocation of Catchment Areas in Great Britain and Ireland: W. J. E. Binnie, M.A. (Great Britain).
69. Factors of Efficiency in Hydro-Electric Development: Lt.-Col. C. M. Norrie, D.S.O. (Great Britain).
70. Water Storage Conditions in India: S. K. Gurtu, M.A. (India).
71. Recent Development in Dam Construction in Italy: Ing. L. Mangiagalli (Italy).
72. Recent Developments in Italian Water Turbines: Ing. Guido Ucelli (Italy).
73. The Coexistence of Hydro-Electric and Steam-Driven Generating Stations as affecting the Economy of Production and the Necessities of Storage and Reserve: G. Motta (Italy).
74. The Generation of Hydro-Electric Power in Canada: H. G. Acres (Canada).
75. Progress in Mechanical Engineering with Reference to Power Production: Verband Der Deutsch-Osterreicher Maschinenindustrie (Austria).
76. Ice Troubles in Norwegian Water Power Plants: Arvid Ruths (Norway).
78. Le Projet d'utilization de Dnièpre.: Prof. I. Alexandrow (Russia).
79. Elimination des débris et broussailles dans les canaux industriels: Cornelio Arellano (Spain).
80. Elimination des apports pierreux dans les canaux industriels: Cornelio Arellano (Spain).
81. Canaux à mi-flanc: Emilo Azarola (Spain).
82. Some Features of Modern Hydro-Electric Developments: Diego Mayoral (Spain).
83. The Regime of Flow of some Spanish Rivers: Carlos Mendoza (Spain).
84. Canalisation and Utilisation of Water Power on the River Guadalquivir: Carlos Mendoza (Spain).
85. General Conditions governing Water Power Production in Sweden: A. Ekwall (Sweden).
86. Recent Practice in Swedish Water Power Engineering: A. Westerlind (Sweden).
87. Recent Practice in Lake Storage and what the Storage Means to Water Power Utilisation in Sweden: Gottfried Berg, C.E. (Sweden).
88. Measures taken in Sweden against Ice Troubles at Water Power Plants: A. Frey Samsioe (Sweden).
89. Recent Swedish Arch Dam Design: Bo Hellström (Sweden).
90. Modern Tendencies in Water-Wheel Design: Prof. Hjalmar O. Dahl (Sweden).
91. Planning of Hydro-Electric Plants with regard to Reliable Operation: K. E. Nylander (Sweden).
92. General Review of Current Practice in Water Power Production: John R. Freeman (U.S.A.).
93. Power in its Relation to Irrigation: Henry J. Pierce and E. C. Bebb (U.S.A.).
94. Power Development on Navigable Rivers: Col. Charles Keller, D.S.M. (U.S.A.).
95. Construction of Dams: Arthur Powell Davis (U.S.A.).
96. Impulse Water-Wheels: William H. White (U.S.A.).
97. The Hydraulic Reaction Turbine: H. Birchard Taylor, M.A.S.M.E., M.S.N.A.M.E. (U.S.A.).
98. Water Power on Inland Waterways: Dr Gleichmann (Germany).
99. The Development of German Water Power: Ministerialrat Krieger (Germany).
100. Experimental Research in the Field of Water Power: Prof. D. Thoma (Germany).
101. Large Low Head Water Power Developments: Dr. Ing. Franz Lawaczeck (Germany).
102. Characteristics and Brief Description of the Scheme for Developing Hydraulic Power from two Important Groups of Waterfalls in the Basin of the River Douro: José Orbegozo (Spain).
103. L'Evolution des idées en matière de régularisation de l'énergie hydro-électrique: MM. Arbelot and Dupin (France).

Section C.—Preparation of Fuels.

111. Complete Gasification of Coal: Prof. Dr. Hugo Strache (Austria).
112. Testing Department for Fuels, Technical College, Vienna: Prof. Dr. Hugo Strache (Austria).
113. Production d'énergie électrique par l'utilisation des gaz de hauts-fourneaux et de fours à coke: M. Cornu Thenard (France).
114. The Winning and Utilisation of Peat: Prof. Pierce F. Purcell, M.A.I., M.Inst.C.E. (Great Britain).
115. The Combustion of Powdered Coal in Cement Rotary Kilns: Dr. C. Martin (Great Britain).
116. The Liquid By-Products of Coal Carbonisation as Sources of Power: W. Gordon Adam, B.A. (Great Britain).
117. The Treatment of Coal, with Special Reference to Low Temperature Carbonisation: Prof. H. E. Armstrong (Great Britain).
118. Oil Refining: C. J. M. Milo (Holland).
119. Preparation of Fuels in Sweden: Dr. Axel F. Enström (Sweden).
120. Saw-Mill Waste as a Fuel: Otto Nordström (Sweden).
121. Power from the Wood-Waste of the Swedish Forest: H. Von Eckermann, Ph.D., M.E. (Sweden).
122. A New System of Oil Production from Swedish Oil Shale: Sven V. Bergh (Sweden).
123. Preparation and Combustion of Fuels: G. F. Hirshfeld (U.S.A.).
124. The Conversion of Coal into Oils: Dr. Franz Fischer (Germany).
125. Low Temperature Carbonisation: Dr. C. H. Lander (Great Britain).
137. Fuel Conservation and Smoke Abatement: F. W. Goodenough (Great Britain).
138. The National Economic Power of Solid Fuel in Relation to its Scientific Utilisation, with Special Reference to Fuel in Pulverised Form: Leonard C. Harvey (Great Britain).
173. The Gas Producer as applied to Large-Scale Power Generation: A. H. Lymn (Great Britain).
267. The Use of Town's Gas in Industry: Sir Arthur Duckham (Great Britain).

The Incorporated Municipal Electrical Association.

Annual Convention at Chester.

(*Continued from p* 38.)

The New President.

MR. W. C. P. TAPPER, who was elected president of the Incorporated Municipal Electrical Association for the year 1924-5 at the annual general meeting at Chester, is one of the distinguished band who served their apprenticeship to engineering with Messrs. Woodhouse and Rawson at their Cadby Hall Works, Hammersmith; he was with that ill-fated firm when it went into liquidation. Subsequently he was for some time in charge of private plant and wiring work, including a short period that he spent at Hanley, Staffs., before the supply of electricity was inaugurated in that town.

In 1894 Mr. Tapper joined the staff of the Brighton Corporation Electricity Department, under Mr. Arthur Wright, and four years later he became Mr. Wright's consulting assistant in the preparation of plans and specifications in connection with the establishment of an electricity supply undertaking for the then existing Board of Works for the Whitechapel District. In March, 1899, he was appointed resident electrical engineer to the Board, and the supply was inaugurated in December of that year. By the operation of the London Government Act which was passed in 1900, Whitechapel was merged in the new Metropolitan Borough of Stepney. On Mr. Wright's retirement, Mr. Tapper was appointed borough electrical engineer and manager of the Stepney Electricity Department, and has held that position to the present day, thus recording over 25 years' service in the employment of the same municipality.

Photo by [*Chidley, Chester.*

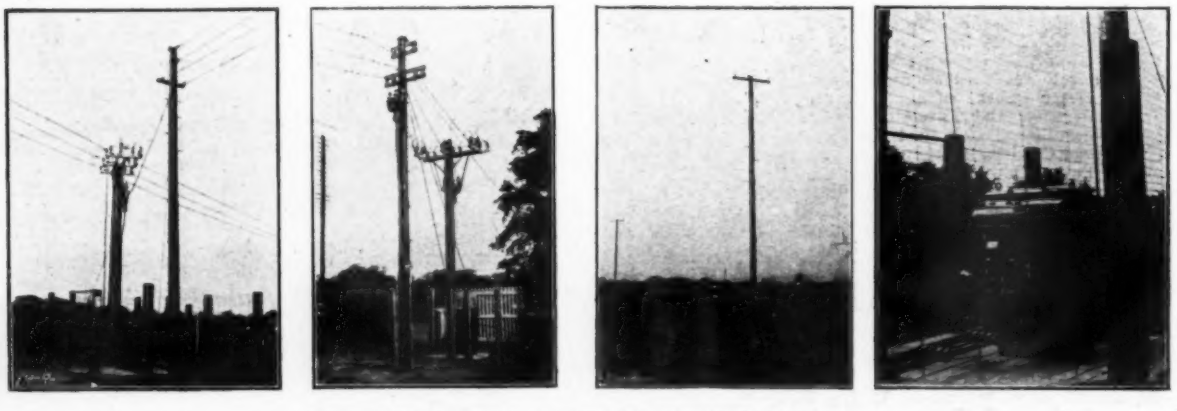
Mr. W. C. P. Tapper,
President of the I.M.E.A.

Mr. Tapper is a member of the Institution of Electrical Engineers, and a past-president of the Associated Municipal Electrical Engineers (London Section). He has been a member of the I.M.E.A. since its inception in 1895, and now is called upon to fill the highest position in the gift of that important body, an office as distinguished as its duties and responsibilities are onerous, but one which Mr. Tapper is well qualified to fill with efficiency and with advantage to the Association, which is to be congratulated on its choice of a leader.

At the annual general meeting, Councillor J. W. Rosenthal, chairman of the Stepney Electricity Committee, expressed the pride and satisfaction of his Council in the honour that had been conferred upon it by the selection of its electrical engineer for the office of president of the Association. Last year the output of the Stepney undertaking was over 42 million kWh sold; total capital expenditure was £1,228,009, and the total income £265,106, producing a surplus of £38,736.

RURAL DISTRIBUTION.

We give herewith some snapshots of the overhead lines and outdoor sub-stations used by Mr. Britton for the supply of electricity in the rural areas adjoining Chester. The construction adopted is very substantial; the system is generally three-phase four-wire with earthed neutral, the latter being split and carried above the live wires, and provided with guard wires at the poles to earth any live wire that may fall. The outdoor



Outdoor Substations and Overhead Lines in the Chester Area.

transformers are mounted on concrete platforms, and surrounded with a wire cage, but the switchgear, as shown, is of the overhead air-break type, and the transformer connections are of lead-sheathed cable with dividing boxes on the poles.

The type of guard wire employed is at present in the experimental stage; in many cases wire hoops, bound on the two neutral wires on either side of a pole, are used, but the V-type is also under trial. Overhead house services have to be made with some six feet of insulated wire next to the building, so that a man on a ladder cannot accidentally touch a live wire. Where Post Office lines are crossed, wire braided and compounded with "P.B.J." is used.

The service has met with a gratifying response, a large number of consumers having been connected in the six months that the supply has been available; many more will take a supply in the autumn, when the long nights draw nigh. In some cases large use is made of cooking and heating apparatus, of which a special feature is made, the lighting service alone offering a poor return on the capital expended.

Annual Report.

The annual report shows that during the year nine municipal committees have been added to the list of members, the largest number since 1914, bringing the membership up to 216.

The position of the G.P.O. with regard to electricity supply authorities has been considered by a sub-committee, and the Council propcses to seek Government support for an Electricity Supply Bill, which will include a clause giving undertakers the right to appeal for arbitration when the statutory rights of the Postmaster-General can be shown to affect the development of electricity supply adversely.

The revised articles of association, which were adopted at the annual meeting, provide that the Association shall consist of full Members and Honorary Members only, all reference to Associates and Associate Members being deleted. Membership of County Councils and Joint Boards is provided for.

A standard agreement for wayleaves in connection with overhead lines has been drawn up and printed.

The I.M.E.A.-B.E.A.M.A. Joint Committee has adopted a resolution in favour of a single specification for large turbo-generators, based on a continuous maximum rating as regards outputs limited by temperature rise, and including a second rating to be called the service or normal rating, this being the most economical load (generally 80 per cent. of the maximum load); the service rating is to be shown on the name-plate.

Tests are to be carried out at the National Physical Laboratory to demonstrate the claim of the Industrial Instrument Section of the B.E.A.M.A. that British instruments are quite as reliable as any foreign make.

The Electric Vehicle Committee of Great Britain reports that on the return of better trading conditions a scheme for extending its operations will be put in force. The need of the moment is the earnest co-operation of the central-station engineers, who should recognise that though battery charging may not be profitable immediately, it will ultimately become as remunerative as power, heating and cooking.

The accounts show an income of £2,203, leaving a surplus of £424. The surplus assets amount to £2,349.

Exhibition of Electric Cooking and Water Heating Apparatus.

A small exhibition similar to that held at Scarborough was held in a building lent by Messrs. Williams, Gamon & Co., and formed a necessary complement to the lighting demonstration.

The British Electric Transformer Co., Ltd., showed a large double-oven cooker for 30 persons, and smaller cookers, fitted with one enclosed-type 900-W boiling ring and one open protected 1,600-W ring, the latter having the "medium" heat element concentrated in the central portion of the ring. The ovens had top and bottom heating.

The B. & K. Accessories Co., Ltd., showed a cooker fitted with a new "universal" enclosed-type boiling ring, having a ventilating aperture in the middle and capable of boiling two pints of water from cold in ten minutes; "pointer" switches were fitted, and a 3-heat grill. Top and bottom heating was used for the oven, but the B. & K. standard practice is to heat from the sides.

Carron Company's cooker had a large 1,500-W grill, and two enclosed boiling rings (but the open type can be fitted), with a sliding shelf under the rings to catch spilt fluids. The oven had top and bottom heat.

The General Electric Co., Ltd., had its standard domestic cooker on show, with one enclosed and one open boiling ring; a "Magnet" sheet-steel portable cooker, which with a separate boiling ring and a 3-pint kettle is hired out at 5s. a quarter; and the "Blighty" washer and boiler, which holds 10 gallons (2-kW) or 14 gallons (3-kW) under 3-heat control, and washes clothes without moving mechanism.

The Hotpoint Electric Appliance Co., Ltd. (Falkirk apparatus), showed the latest model of cooker specially designed to be suitable for baking bread, with side and bottom heat, and a 10-12-gallon water boiler taking 4-kW 3-heat, with blue glass-enamel lining. One of its cookers had a drop-down oven door. The advantages of square pans over cylindrical were demonstrated by this firm.

The Jackson Electric Stove Co., Ltd., showed a new cooker for 12 persons, and other sizes of cooker. The boiling rings were loaded to 1,500 watts each, with semi-enclosed elements. There was also a wash boiler, with readily renewable elements, and a 7-gallon 100-watt water heater.

Messrs. Arch. Low & Sons, Ltd., exhibited the "Highlow" hot-water tanks, of different types, a 150-watt water-filled towel rail, and a cooker of the "Liverpool Corporation" pattern for 8-10 persons, in two parts, with open boiling rings. A bowl reflector was fixed under the ring, and the elements were shielded, with a large aperture in the middle of the ring. A 2-gallon tank heated with waste heat from the boiling rings and provided with an immersion heater in addition was shown. Another item was a neat water-filled radiator.

Messrs. Bastian & Allen showed a novelty in the shape of a small boiler heated with elements in quartz tubes and giving superheated steam; the water-heating element was loaded to 1,500 watts and the superheater with 750 watts. A 2-kW boiling plate fitted with quartz tubes enclosing the heating elements showed how red-hot elements could be used with perfect protection from spilt liquids, &c., for cold water can be poured continuously on the tubes without damaging them.

Messrs. George Nobbs, Ltd., showed the "Genii" water heaters, various types of geysers, &c., and immersion heaters.

Brookhirst Switchgear.

The works of Messrs. Brookhirst Switchgear, Ltd., a short distance outside the city, were open for inspection during the convention, and were humming with activity. The works are well arranged for the production of standard switchgear of the well-known Brookhirst patterns, the parts being manufactured to interchangeable dimensions and assembled in such a way that the apparatus move continually forward through the shops until they arrive as finished products at the end of their journey. Some interesting new designs have been developed and are being manufactured in quantity.

In the detail assembly shop, machined parts are assembled such as contactors, overload trips, and similar components almost entirely by unskilled labour. In the main assembly departments a progressive assembly system is adopted.

The slate slabs are hung on a rack and move down the shop, being fitted on the way with the required switchgear. At a certain part the slabs with switchgear are fitted into the sheet steel cases. Resistances are then fitted, and the control gear passes straight out for inspection and test.

It is a fundamental "Brookhirst" principle that motor-starting switchgear should include complete protection for the motor against breakdown and provision against the possibility of shock to the operator, and that all the components for the control of a single motor should be embodied in one ironclad unit. All Brookhirst control gear for normal industrial requirements is designed along these lines.

Thrust Boring.

The Maugnall-Irving thrust-borer was shown in operation by the Hydraulic Engineering Co., Ltd., on ground adjoining the Switchgear Works. With this device, which was described in our issue of April 21st, 1922, holes can be bored and pipes and-or cables inserted under streets, railways, &c., without affecting the surface, and the esteem in which it is held may be gathered from the fact that the Post Office Engineering Department has nine of the machines in use, and Manchester Corporation five. Besides the saving in time and cost effected by its use, there is the advantage that traffic is not interrupted and the public suffers no inconvenience.

Helsby Cable Works.

The visit to the Helsby Works of the British Insulated and Helsby Cables, Ltd., was full of interest, and a very large contingent took part in it, to the gratification of the directors, who entertained the visitors lavishly. The factory is engaged mainly in the production of rubber-covered cable and wire in numerous varieties, from small flexibles up to lead-sheathed and armoured cable, and condensers of the Mansbridge type from small telephone condensers up to 300-kVA power-factor correction condensers. The construction is essentially similar in all cases, bands of tinfoil being rolled up with one to three interleaves of tough tissue paper according to the voltage. After "winding," the telephone and wireless condensers are dried electrically, impregnated with wax, and pressed flat. When cool they are fully tested before sealing in metal cases. Power-factor condensers, which the company began to make 18 years ago, are impregnated with oil instead of wax and are provided with passages to ensure the circulation of the oil in which they are immersed. They are assembled on frames and fitted into a strong steel tank. At every stage the parts are thoroughly tested. Over 50,000 kVA of these condensers have been manufactured and sold. The guaranteed efficiency is 99.5 per cent.

Many of the workers were girls, and the visitors were struck with their uncommonly handsome and healthy appearance.

(To be continued.)

Electricity in the Home.

The North Metropolitan Demonstration House.

AN area of some 326 square miles in North London is supplied with electricity by the North Metropolitan Electric Power Supply Co., which sold during 1923 a total of some 79½ million kWh either directly or indirectly to 37,000 consumers.

An indication of the increased domestic application of electricity is the fact that the company was given the contract to wire 250 houses in course of erection by Mr. H. G. Stacey at Bush Hill Park, Enfield, and

Fig. 1.—The North Metropolitan "Electricity House."

in order to demonstrate to the district the many domestic uses of electricity, the company has fitted one of the houses on the estate with electrical apparatus. "Electricity House" at 178, Village Road (opposite St. Stephen's Church), is true to its name, as will be appreciated by the accompanying illustrations.

Attention is drawn to the house by a large sign at the side, and a K.F.M. sign in the porch for day and night use; a bell transformer is used for operating all the bells in the house. In the hall is found a "Crypto" rectifier, also a "Tungar" rectifier for battery charging which facility is a great convenience when broadcast radio receiving apparatus is used.

The drawing-room (fig. 2) contains a "Magicoal" fire, which gives out a comforting glow. An alabaster bowl is used as a light diffuser. No house is complete without its gramophone and radio outfit; the former is represented by an electrically-driven machine by Electric Gramophones, Ltd., and the latter is an Ediswan "Two Vee" set with a loud speaker.

In the dining-room (fig. 3) is a three-light rise-and-fall pendant fitting with a silk flounce, and in this room are to be found many useful appliances, such as a Singer electric sewing machine, coffee percolator, tea infuser, toaster, table grill, and warming plate. A Metropolitan-Vickers electric fan is provided for hot weather, and for cold days a Belling fire fitted with hot cupboards. An electric clock on the mantelpiece requires no winding, as its speed is regulated by Greenwich time from the power house. Statuettes with candle lamps and shades give a pleasing effect on the mantelpiece.

The kitchen (fig. 4) is fitted with a "Falco" cooker (No. 5,279), the oven of which is provided with a thermometer. The "Steemkleen" electric boiler and washing machine stands in a corner, and the following household utensils are on view:—A 3-pint "Xcel" kettle, a 1-kW Belling boiling ring, a 5-lb. iron, and a "Universal" toaster.

On the landing are a Hoover suction sweeper and a bowl fire. The bathroom (fig. 5) is fitted with a Bastian geyser, which provides a supply of scalding hot water at any hour of the day or night. A Belling "Fixall" 2-kW fire finished in white enamel is a useful component.

In the front bedroom is a two-light rise-and-fall pendant over the dressing table, also a light over the bed, controlled by 2-way switching, whilst an "Adjustolite" clipped to the bed is a very suitable reading lamp. A hair-drier, curling-tongs heater, shaving mug, early morning tea set, with electric kettle and Belling "Derby" fire are among the many conveniences on view in this room.

The nursery is provided with a Bastian & Allen non-luminous type of air warmer, as being particularly suitable for children. An electric food warmer and a B.T.-H. "Nitelight" are also on view.

Another room (fig. 6) on this floor is arranged as a showroom, with a number of fittings and appliances, one of the most novel and interesting being a B.T.-H. toy transformer suitable for working tiny motors and apparatus from the lighting supply. A point of considerable interest to local people is the large proportion of apparatus on view made by firms in the neighbourhood, such as the lamps and radio apparatus by the Edison Swan Electric Co., fires by Belling, switchplugs by M. K. Accessories Co., and electric fans and bowl fires made by Metropolitan-Vickers at the Cosmos Works.

Fig. 2.—Drawing Room.

Fig. 3.—Dining Room.

From time to time apparatus will be changed, and all is priced with labels and tickets. Householders will be much interested in the furniture, floor coverings, and curtains, which have been supplied by Messrs. Henry Haysons, of Palmer's Green. With the exception of the cooker and other heating appliances, nearly all the apparatus uses a very small amount of electricity, approximately 15 hours' use for one kWh being the average.

The object of the demonstration is to show how economical and helpful electricity can be in a home where the income is very modest, and particularly where the servant problem has been most acute. This is a luxury home, but also an economy home. The hours of opening are 10 a.m. to 7 p.m. (Sundays excepted), or such other hours as may be found advisable. Full explanations of the cost and convenience of all the apparatus will be given by the attendants.

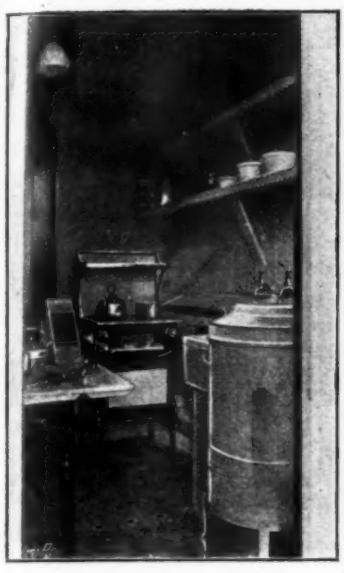


Fig. 4.—Kitchen.

Fig. 5.—Bathroom.

Fig. 6.—Showroom

The National Physical Laboratory.

Annual Inspection.

THE annual inspection of the laboratory by the General Board took place on June 24th, a large number of visitors being received by Sir C. Sherrington, O.M., president of the Royal Society and chairman of the Board; Sir A. Schuster, F.R.S., and the director, Sir J. E. Petavel, K.B.E., D.Sc., F.R.S. During the afternoon tea was served in the new aerodynamics building and the extensive gardens of Bushy House were open to the guests.

As is customary, apparatus was exhibited and demonstrated, while experiments being conducted were watched with interest. A feature of the work at Teddington is the large part that electrical methods and devices play in assisting the carrying out of investigations in the numerous departments. For instance, in the section devoted to aerodynamics, in connection with the exploration of airflow around a monoplane aerofoil, the velocity and direction observations are taken with a specially designed hot-wire yawmeter, while the two fans of the duplex wind tunnel are each driven by a 200-h.p. motor, the control being on the Ward-Leonard system of armature regulation, with an additional fine control in the field circuit. The switchgear is below the tunnel immediately under the motors and is operated from the platform by press buttons.

Of interest also is an electrical method of determining the theoretical streamlines for an inviscid fluid moving past a flat plate. If an insulated conductor is placed in the electrical field between two parallel plates, the equipotential lines are identical in form with the streamlines in a perfect fluid flowing to the plates past the same obstacle. The apparatus shown was designed to provide a convenient and rapid means of tracing those equipotential lines. A water tank has two aluminium plates placed in contact with its longer sides; the model is placed in the centre of the tank with its span vertical, and two platinum electrodes, fused into the ends of fine glass tubes, dip into the tank to half the depth. The alternating potential difference is obtained from an oscillating valve circuit in which the secondary and primary windings of an ordinary low-frequency intervalve transformer are used in the plate and grid circuits respectively. The two exploring electrodes are connected to telephones through a three-valve audiofrequency amplifier. One of these electrodes is fixed at any convenient point and the other is moved successively to a number of points where no sound can be heard in the 'phones. All such points are on the equipotential through the fixed electrode—*i.e.*, on a streamline for the case of fluid flow. By setting the fixed electrode in a number of different places, any required number of streamlines can be drawn. For convenience, the exploring electrode is moved on a pantograph framework, and a pencil traces an exactly similar path over a sheet of paper at the side of the tank. The streamlines can thus be plotted directly on to the paper. If the model, instead of being insulated, is given a definite potential by connecting it to a point on a potentiometer across the alternator terminals, it is possible by exactly similar methods to draw the streamlines for the case of fluid flow with "circulation." The strength of the circulation is dependent on the chosen potential at which the model is set.

In the engineering department a new 100-h.p. variable-speed electrical dynamometer was seen; it resembles somewhat an ordinary motor and was made by Messrs. Mather and Platt to produce full torque at from 20 to 1,700 r.p.m. The field-magnet frame is mounted on roller bearings and is provided with a pointer and weight pan. The power transmitted is measured mechanically to one-tenth of 1 per cent. The Brookhirst control panel is provided with special interlocking arrangements.

In the foundry of the metallurgy department the melting of pure electrolytic iron *in vacuo* by means of a high-frequency furnace was watched with interest. A coil surrounding the metal to be melted induces eddy currents in it so as to generate sufficient heat to melt the metal. In connection with the preparation of pure metals, iron and chromium of 99.98 per cent. purity are produced by passing an electric current through suitable solutions of salts of the particular metal. Metals of this high degree of purity are very rarely produced and are absolutely necessary as standards of reference in the important researches of the Laboratory, which, working in conjunction with the Iron and Steel Institute, has provided seven standards of steel and cast-iron and is at work on further standards. Samples can be purchased by any person interested.

Other items were the production of fused magnesia crucibles by electric arc heating and the thermostat-controlled electric furnace for the prolonged heat treatment of alloy specimens.

The average number of clinical thermometers tested each week is at present in excess of 15,000, and new X-Ray equipment has been provided for testing the glass of which the stems are made. Amongst the experiments carried out in the physics department are those connected with sound-wave photography, the study of the transmission and reflection of sound by partitions in chambers, the production of a series of oscillations of standard acoustical frequency by a tuning fork-controlled oscillator, and the study of the output of electrical sonometers, oscillators, amplifiers, &c., used in acoustical work by means of an oscillograph.

During the past year the X-ray section has given much assistance in the examination of the radiological departments of hospitals all over the country with a view to ascertaining whether the protection afforded to the X-ray staffs is in accordance with the recommendations of the X-ray and Radium Protection Committee. The apparatus used for this work was demonstrated, and it was of interest to note the heavy protection employed at the laboratory for the high-voltage X-ray installation used for the examination of metals, &c.

A constant temperature room is used for carrying out very precise measurements in which a small difference of temperature would seriously affect the accuracy. For example, angles may require to be measured which correspond in size to the angle between two lines drawn from a point to the top and the bottom of a halfpenny at a distance of thirty miles—representing the measurement of the angle between two practically parallel lines.

The room is cooled by air from a refrigerating plant and warmed by air passed over electric heaters when required automatically by an electrical thermometer consisting of a fine grid of wires a little below the ceiling, sensitive to 1/100th deg. C. Colour is being standardised at the laboratory with a view to ultimately setting up a series of colour standards expressed in terms of the sensations of the eye, and it is hoped that, ultimately, it will be possible to express any colour with absolute precision simply by quoting a reference number.

In the electrical department, a.c. division, an interesting physical phenomenon was a cylinder rotating with no visible driving mechanism. A rotating electric field of an intensity of the order of 1,000 volts per centimetre, is produced in air by exciting three metal balls 2 inches in diameter with a three-phase voltage of about 20,000; the field rotates 50 times a second. Most insulating materials absorb a small amount of energy when subjected to an alternating voltage. This can usually be detected at a few volts, and is frequently a very important characteristic both at high and low voltages. If a cylinder of material of this character, such as celluloid, for instance, is placed in a rotating electric field, it is acted upon by a force tending to drag it round, and if free to move it can be made to spin at a rate of several revolutions per second. The greater the energy loss due to imperfection of insulating property, the greater the torque and the speed at which the insulating material will rotate, except that the speed cannot reach that of the rotating field. By interchanging two of the three connections from the a.c. supply, the direction of rotation of the electric field can be reversed. This puts a brake on the rotating insulation which stops, and starts rotating in the opposite direction.

During an investigation to determine the most suitable methods of making electrical connection to earth, interesting effects of the movement of moisture with the passage of a small current were obtained and in an experiment shown in the d.c. division the passage of a few milli-amperes (1/1,000 ampere) through the damp soil caused the water from the soil to ascend a glass tube to a height of 12 ft.

Railway electrification has brought to light several new problems arising from the use of high-pressure direct current. A special generator (giving 5,000 volts) complete with special switchgear is installed for such investigations. It has already been used for the testing of the specially impregnated timber used for protecting railway track workers from accidental contact with live rails, and the machine is provided with high-power valves arranged for loading and with a non-reactive voltage-dividing resistance.

The ever-increasing use of radio frequency communication is rendering of increasing importance an accurate knowledge of the frequency of the transmitted waves and of the settings of the circuits to receive them. The development of accurate frequency standards at the N.P.L. has been carried to a high degree of accuracy, and with a view to rendering the standards developed of the greatest use, a scheme of transmission of waves of standardised frequency has been inaugurated. Among the exhibits demonstrated in the Wireless Division was a complete set of apparatus for the determination of the intensity of the field of electromagnetic waves arriving from a distant transmitting station. The signals are received on a frame coil and after amplification are recorded on a moving-coil galvanometer. The deflection obtained is compared with that produced by an accurately calibrated local oscillator, thus enabling the absolute value of the field to be calculated. A string galvanometer is used for the quantitative reception of signals. Apparatus was also shown which enables the direction of both the electric and magnetic forces in electromagnetic waves to be separately determined. Only from a knowledge of both these directions can the wave front be completely determined.

An arrangement of a rectifying valve circuit with a reflecting galvanometer was shown as a suitable method of making measurements on receiving aerials, earths and screens and receiving apparatus, particularly with reference to the broadcast band of wave-lengths. The apparatus is at present used on a typical broadcast receiving aerial, with alternative connections to a buried earth plate, water, and gas pipes, and on an earth screen. Among the standard testing apparatus demonstrated was a panel for measuring all the static characteristics of receiving valves, and a set for examining the amplifying properties of audio-frequency intervalve transformers. In the latter arrangement the actual voltage-amplification produced by a stage comprising one valve and one transformer is measured by a comparative audibility method at any frequency from 250 to 4,000 cycles per second. Using standard types of amplifying valves this measurement enables a study to be made of the frequency distortion introduced into speech-frequency amplifiers by the iron-cored intervalve transformers. Other apparatus was demonstrated by which the input and output of any standard amplifying-detector may be measured. This enables a complete study to be made of the behaviour of an amplifier at either radio or audio frequencies. A novel design of audio-frequency amplifier employing a special type of non-inductive resistance is in use for the amplification of received broadcast signals.

Legal.

British Thomson-Houston Co. Litigation.

THE British Thomson-Houston Co., Ltd., applied before Mr. Justice Tomlin in the Chancery Division on July 4th for its motion against the Z.W. Trading Co., Minories, E.C., for an injunction restraining alleged infringement of one of its electric lamp patents to be dissolved.

Counsel for plaintiffs said that the application was the result of a decision of the Court of Appeal in an action over the patent in question. He could not make an end of the action, and asked that it should stand over pending the hearing of the plaintiffs' appeal to the House of Lords.

His LORDSHIP assented to this course, but said that the defendants would have the costs of motion in any event, the motion being dissolved.

On the same day the B.T.H. Co. moved for an injunction restraining the City Accumulator Co. from an infringement of its trade-mark "Tungar" in respect of rectifiers for alternating electric current, and from passing off.

Counsel for defendants said that they bought the apparatus from the French Thomson-Houston Co., bearing the word complained of, in all innocence, and imported it into this country. When they found that the word was the property of the plaintiffs they were willing to consent to an injunction in the terms of the notice of motion.

His LORDSHIP said there would be a perpetual injunction by consent, in the terms of the notice of motion, an inquiry as to damages, destruction of all advertising matter, and deletion of the word "Tungar" from the goods in question.

Parliamentary.

Clyde Valley Electrical Power Bill.—This Bill was considered by a committee of the House of Lords on June 26th. Its main purpose was to enable the Clyde Valley Electric Power Co. to raise additional capital to the extent of £1,000,000, and to extend its area of supply to include various parishes in Lanark and one in Dumbarton. There were originally a number of petitions against the Bill by various local authorities and railway companies, who sought protective clauses, but in every case, except that of the Glasgow Corporation, the objections were met before the Bill reached committee.

Mr. ROWLAND HARKER (for the promoters) said that the company had been one of the most active in developing its area of supply, and that the amount of energy sold to power users or in bulk last year was between 125 and 130 million kWh.

Dealing with the opposition of the Glasgow Corporation, he said it was claimed by the Corporation that, in view of the fact that it had important public utility undertakings far beyond the area of the City, such as sewer works, water mains, tramways, &c., provisions should be inserted in the Bill for the protection of that property. Counsel pointed out, however, that the company was willing to undertake not to interfere with the interests of the Corporation without its consent, and that, he contended, was of more value to the Corporation than a protective clause. The promoters were not asking for any compulsory powers so far as the Glasgow Corporation was concerned.

Evidence in support of the Bill was given by Mr. E. T. Goslin (general manager of the company) and by Mr. W. Johnston (solicitor to the company). In the course of cross-examination by Mr. M. P. Fraser, K.C. (for the Glasgow

Corporation), Mr. Goslin pointed out that in the company's original Act, in 1901, there were clauses for the protection of the Glasgow Corporation.

Mr. M. P. FRASER, K.C., addressing the Committee on behalf of the Glasgow Corporation, said that it was the practice of Parliament when a private company obtained power to occupy streets and roads, to make provision for the protection of the property of local authorities. Dealing with the position of the Corporation as electricity undertakers, he referred to the extensions of the Glasgow electricity supply area made from time to time. The Clyde Valley Co. had been supplying electricity in part of the area taken over by the Corporation in 1912, and when the Corporation's area was extended, the company had received a protective clause. Also, in the company's Act of 1901 the Glasgow Corporation obtained a protective clause.

The undertaking offered by the company, not to interfere with the interests of the Corporation without permission, did not meet the objection of the Corporation, namely, that it would not have, under the new Bill, the same protection that it had under the 1901 Act. The Bill would enable the company to exercise compulsory powers. It would authorise it to acquire the generating or distributing undertaking of another company, and to exercise that company's powers, and that was not dealt with in the Bill. These powers might be very extensive, and might be used to the disadvantage of the Corporation.

The Committee directed that the Bill should be allowed to proceed, without the protective clause asked for by the Corporation.

The Thames Wharf Scheme.—The Bill for a deep-water wharf scheme for the Thames, between Purfleet and Tilbury, with railway and other services (to cost £3,000,000) was rejected on June 30th, as the Committee of the House of Lords could not see its way to get over the statutory provisions of the 1908 Act, giving jurisdiction as to the granting of licences for wharves within the Port of London, to the Port of London Authority.

Yorkshire Electric Power Co. Bill.—On July 2nd and 3rd, this Bill, in which the company sought to extend its area of supply, &c., came before a Select Committee of the House of Lords. Mr. W. J. JEEVES, K.C., who represented the promoters, after reviewing the history of the company, objected to the opposition put forward by the Sheffield and Rotherham Corporations. He said that neither authority was in the area outlined in the Bill; they were in the North-East Midlands Electricity District, but were not directly affected. The Committee decided that the two Corporations were entitled to oppose.

Mr. W. B. WOODHOUSE, engineer and manager of the company, gave evidence in support of the Bill, and Sir JOHN SNELL said that a settlement had been arrived at in the district named, and this supplemental Bill was necessary to give effect to that settlement.

Sir LYNDEN MACASSEY, K.C., for the Sheffield and Rotherham Corporations, said that his clients objected to this piecemeal legislation, and considered that it pre-judged what would be done in the North-East Midlands District. The Bill was connected with a scheme that had not yet been presented to Parliament. The Committee decided that the Bill, as drafted, should not proceed.

Sale of Wireless Plant.—On June 30th, Mr. HARTSHORN, the Postmaster-General, informed Mr. BAKER that it was not his intention to sell any workable wireless station in this country to any company which was not registered in Great Britain; and in the event of any station being sold, it would be on terms which would adequately safeguard the interests of the State.

Long-distance Wireless Telephony.—On July 1st, Mr. HARTSHORN informed Sir BURTON CHADWICK that it was not intended to establish at present a special station for long-distance wireless telephony. The decision in the matter was dependent on the results of the experiments to be made between the new wireless station in course of erection at Rugby and the United States of America.

The Broadcasting of News.—On July 1st, Mr. HARTSHORN said that the licence granted to the British Broadcasting Company on January 18th, 1923, provided that the company might not broadcast news except such as it might obtain from certain approved news agencies, and under the company's arrangements with the agencies, news might not be broadcast before 7 p.m. He had asked the Broadcasting Board for an expression of its views on the question of an extension of the facilities for the broadcasting of news, and he understood that the Board was at present considering the matter.

Wireless Receiving Licences.—On July 1st, Mr. HARTSHORN informed Sir H. BRITTAIN that the total number of wireless receiving licences on May 31st in England and Wales was approximately 702,000 and in Scotland 98,000.

Underground Cables. — On July 2nd, Commander BELLAIRS asked the Postmaster-General if he would state what towns in Kent outside a 25-mile radius from London were connected to London by underground telephone cables, or were about to be so connected.

Mr. HARTSHORN said that Canterbury, Chatham, Dover, Faversham, Maidstone, Margate, Ramsgate, Sheerness, Sittingbourne and Tunbridge Wells were at present connected with London by underground telephone cables, and Folkestone and Tonbridge were about to be so connected.

Reviews.

Principles of Electric Motors and Control. By GORDON FOX. Pp. xiv + 499. Figs. 298. London: McGraw Hill Publishing Co., Ltd. Price 17s. 6d. net.

Foremost among the advantages possessed by the application of electrical power to industrial drives is the wide range of performance of the electric motor as exemplified in its many types. This diversity in characteristics and performance entails a responsibility on the part of the prospective user in making a suitable selection of machine and its controlling gear, in order that the best results may be obtained. The efforts of the designer and manufacturer may be lost unless forethought and knowledge is brought to bear upon the conditions and requirements of the service to which their machine is to be put. Not only must the motor chosen possess characteristics suitable to the nature of its load, but it is equally important that the controlling apparatus should enable its inherent ease and flexibility of speed variation to be obtained. This book has been written with the object of presenting the principles of motors and motor control to those interested in the selection of such apparatus. In the first chapter on motor action the author addresses himself to the layman, but very soon forgets all about him. The theoretical treatment is purely descriptive and well written, but naturally cannot be altogether convincing either to the layman or the electrical engineer, since all vector diagrams are avoided as too complicated. The working principles of direct current, polyphase induction and synchronous motors, single-phase commutator motors and the brush-shifting, three-phase commutator machine are very ably treated in this easy manner and their performance curves explained. The subject of speed control of induction motors is not neglected. Methods of changing the number of poles, cascade sets, dynamic control on the Krämer and Scherbius systems, are dealt with in an adequate way. Although this is an American book, we should have expected some reference in the text to the work of Hunt and Creedy in this country to have been included in the section on multispeed induction motors, and for the author to have ignored the Hunt cascade motor is a regrettable omission. The question of power factor control when a commutator machine is introduced into the rotor circuit of an induction motor for the purpose of speed variation merits a fuller treatment than that accorded to it. Economical speed variation and improved power factor in induction motors have enormously extended the possible applications of this type of machine and engineers should be placed in possession of information relative to the recent advances in this direction. The latter half of the book is devoted to the practical application of principles of direct and alternating motor control. Types of controllers and starters, automatic starting, remote control gear, and electric braking, receive full attention, and these chapters are well illustrated by clear line diagrams. The volume bears the impress of an expert in this branch of electrical engineering and should find a place in every good reference library.

Electricity and its Application to Automotive Vehicles. By PAUL MCDOWELL STONE. Pp. xvi+844; figs. 395. London: George Allen & Unwin, Ltd. Price 18s. net.

This book is of transatlantic origin. It aims at instructing those concerned with the use and maintenance of "automotives," *i.e.*, petrol cars, &c., in first, the elements of electrical and magnetic science, and secondly, the detailed construction, adjustment, and maintenance of a great variety of electrical apparatus and accessories forming part of the equipment of such vehicles. Electrically-propelled vehicles are not dealt with at all, a fact noted, not as a matter for complaint, but only to indicate that electric traction is not a subject of the book.

Nine chapters are devoted in the main to elementary instruction in electricity and magnetism. On the whole, these chapters set out the principles of these subjects in a satisfactory manner for the proposed purposes of the book, *i.e.*, to give people concerned in the working of petrol motor vehicles a grounding in the scientific principles applied and involved in the working and adjustment of the electrical apparatus used on such vehicles. The quantitative relations of electrical units *inter se*, and their relations to the mechanical units of force, energy, power, &c., are explained in a clear and practical way. If anything, the theoretical treatment goes rather beyond the strict necessities of the subject. This is a fault on the right side, and perhaps due to the writer's feeling that a great many of the readers for whom the book is designed may have little opportunity or inducement to obtain electrical instruction except such as is required for the understanding of the electrical apparatus on the cars which they use or have to repair.

Unfortunately, the theoretical work is not altogether accurate, and if any readers take the book—as some very well may—as in part an elementary scientific treatise, they will imbibe some notions which are not concordant with current science. The statements to which exception can be taken on this ground are generally not of practical importance, but there are some which are distinctly misleading, and if their inaccuracy is revealed to any reader by trial, this may induce a regrettable mistrust of theory. For instance, with respect to the regulation of charging current and voltage (p. 354):

"the current sent through a battery will be in direct proportion to the voltage of the generator which is connected in the circuit with it, as the resistance of the charging circuit remains practically constant."

It is in respect of magnetism that the theoretical treatment is least satisfactory, and most likely to confuse a reader who has no other source of information. For example, on p. 4 the reader is told: "Always bear in mind that the magnetic lines of force do not really exist, but are imaginary, and are designated thus to show the direction and strength of the magnetism in the magnetic circuit"; whilst on p. 144 he is told: "The magnetic lines of force which spring into existence about wire A cut across wire B, and as a result an electromotive force is induced in the latter." Again, definitions are given of magnetic conductors and non-conductors. "Conductors are substances capable of conducting magnetism from one place to another, or of altering the path or direction of magnetic lines of force. The most important are iron and steel. The lines of force pass through other substances, but are not conducted by them. Such substances are non-conductors of magnetism." Also: "when a magnetic substance is used for the core of a solenoid, it greatly multiplies the magnetising power of the coil."

It is not the reviewer's desire to emphasise these unfortunate statements. They do not detract from the main object and utility of the work, but it is a pity that any instruction with the appearance of authority should include statements which tend to confuse, or which must be unlearned if the reader pursues the study of the science.

Turning to the more important practical side of the book, it is a pleasure to be able to say that it is well done and calculated to be of great value to those who may be called upon to maintain and repair American cars of many different makes. An English reader is amazed at the great number of electrical appliances described, and at the variety of designs which are evidently in use in the U.S.A. The descriptions of these appliances are fully detailed and illustrated by a large number of plates. They do not read like extracts from catalogues, but rather like the descriptions of a competent engineer who has handled and used them.

The large number of ignition and starting arrangements is particularly striking. It gives one the impression that some of them are due to an expenditure of ingenuity in devising something different from any other fellow's; but many are clearly designed with a good knowledge of practical conditions. Magneto ignition occupies a relatively small space; whether this indicates that battery and coil ignition predominates in American cars, the writer is hardly qualified to say. At least there are a great many more battery and coil systems than magneto systems described, but this does not necessarily mean that there are more American cars in use with the former than with the latter. The Ford ignition gear is well known on this side as a combination of low-pressure magneto and induction coils; there are several others described, some combined with alternative battery supply to the coils.

A considerable number of complete "systems," each including generator, battery, starting motor, ignition and lighting apparatus as a coherent whole, are described and illustrated. These electrical sets are generally manufactured by electrical firms and supplied to the car builders. Each has its peculiarities. The multiplicity of designs must involve rather a serious tax on the storage space and capital of any general repairing workshops in the States which aspire to keep spare parts for any car which happens along. One cannot help feeling that a considerable amount of standardisation and reduction of the number of designs is due and inevitable in the near future.

A valuable feature of the book, showing the author's practical knowledge and experience, is the enumeration of possible troubles, the methods of detection, localisation, and correction, and directions for adjustment.

The book will be valuable to the proprietors and staff of garages and repair shops in this country who meet with large numbers of American cars. If the numbers and makes of cars of American manufacture used here increase much—as some people anticipate they soon will—the value of such a work will also increase. Evidently the cleverest of mechanics cannot at once see through the intricacies of the connections on a car employing a system not previously met with, and if he can look up a description of it, he will be saved a good deal of time in unravelling them.

The book can therefore be confidently recommended to people who have to be ready to deal with troubles on cars of any and every make. It is well printed and bound.

It may be noted among the omissions of the book that the Edison alkaline battery is not described or mentioned.

H. M. S.

Colliery Electrical Engineering. By G. M. HARVEY, M.Sc., B.Eng., A.M.I.E.E. Pp. xi+387; figs. 153. London: Sir Isaac Pitman & Sons, Ltd. Price 15s. net.

In this work the author assumes that the reader has already acquired a working knowledge of the theory of direct and alternating currents, and the construction and working of electrical apparatus in general, and deals only with the questions arising in the application of electricity in mines to the laying out, equipment and maintenance of a colliery electrical installation.

The work is divided into seven chapters, the first dealing generally with the transmission of power in mines and the relative efficiencies of the various systems; the second discusses the question of supply of electricity, and compares the advantages of a colliery receiving a supply from a power supply company, with the installation of an independent generating station. Chapters 3 and 4 deal with the power station, and we thoroughly agree with the author in his condemnation of the practice of placing winding engines, air compressors and turbo-alternators all in one house. The winding engines at least should be absolutely separated. Chapter 5 deals with the surface installation of plant, such as substations, electric winding engines, transmission lines, &c., while Chapter 6 deals in a similar way with underground plant. Chapter 7 deals with "Administration" in a really excellent way, and for this chapter alone we should like to see the book in the hands of every responsible colliery director. In this, the question of the staff is discussed, and some excellent examples of inspection report books, repair instruction notes, recording cards for motors, cables, &c., are given. We also agree with the author's remarks on "Buying" that "the electrical engineer will be well advised to insist upon his right to control the issuing of inquiries and to have a voice in the selection of the tender to be accepted." Too often the engineer has to accept what arrives in response to his requirements.

Altogether it is a very good book, and in many respects will fill a long-felt want. It is well printed, contains 153 illustrations, many of them being useful "curves" of various data, and the half-tone illustrations are very clear, well defined and new. It should be of considerable interest and value, especially to those who are considering the installation of electricity and the best means of doing so.

Business Notes.

Bankruptcy Proceedings.—EDWARD GEORGE NICKS, 19, Ruby Street, Bedminster, Bristol, late 141, North Street, Bedminster, electrical engineer.—The first meeting of the creditors herein was held on July 2nd at the Official Receiver's Office, 26, Baldwin Street, Bristol. According to the statement of affairs there were liabilities of £438 and a deficiency of £317. Debtor commenced business in March, 1923, as an electrical engineer, with £20 capital, and he stated that he had paid a composition of 10s. in the £ on a previous occasion. The case being a summary one was left in the hands of the Official Receiver as trustee.

E. E. MEARNS, electrical contractor, 14, St. Bede's Road, East Boldon, Northumberland.—Trustee, Mr. C. Woollett, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne, released June 23rd.

H. BOOCOCK (HARDWICK & Co.), electrician, 28, New Lane, Selby.—First and final dividend of 1s. 2d. in the £, payable July 25th at the Official Receiver's office, 24, Bond Street, Leeds.

A. J. BARLOW (Barlow Bros.), electrical and general engineer, 9, Brunswick Place, City Road, E.C.—Last day for proofs for dividend July 18th. Trustee, Mr. A. J. Carey, 49, Queen Victoria Street, E.C.

A. W. BOULD, electrician, 29, High Street, Skipton.—Last day for proofs for dividend July 18th. Trustee: Mr. W. Durrance, Official Receiver, 12, Duke Street, Bradford.

D. C. BATE, electrical manufacturer and supplier, 16, John Dalton Street, Manchester.—Last day for proofs for dividend July 19th. Trustee: Mr. J. F. Warburton, 28, Queen Street, Manchester.

D. JOHNSON, electrical contractor, 177, Woodhorn Road, Ashington, Northumberland.—Last day for proofs for dividend July 23rd. Trustee: Mr. C. Woollett, Official Receiver, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne.

R. S. MAGSON (R. S. Magson & Co.), electrical engineer, 10, Stoney Stanton Road, Coventry.—Second and final dividend of 2s. 5½d. in the £, payable at the Official Receiver's office, 9-11, High Street, Coventry.

Company Liquidations.—SUTHERLANDS (ELECTRICAL ENGINEERS), LTD., Bolton.—In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors was held recently, when the liquidators appointed in the voluntary liquidation of the company submitted a statement of affairs which showed liabilities of £5,677. The indebtedness to the trade was £2,762, while the bank was scheduled for £1,825, and there were cash creditors whose claims aggre-

gated £1,090. The assets were estimated to realise £3,170, from which had to be deducted £136 for preferential claims, leaving net assets of £3,033, or a deficiency of £2,643. The assets consisted of: Cash in hand, £3 11s. 7d.; stock in hand, £1,545, estimated to realise £1,250; machinery, £105; trade fixtures, fittings, utensils, &c., £103; good book debts, £1,688; and doubtful and bad debts, £157, valued at £20. It was stated that something like 140 creditors were interested. For the purposes of the statement of affairs the assets had been valued on the basis of a going concern. It was hoped that such a sale could be effected. If a sale as a going concern, however, could not take place the assets might not realise the figures shown. There were two branches of the business, one at Radcliffe and the other at Bolton, but the whole of the assets were included in the statement of affairs. The cash creditors were the directors, whilst one outside gentleman had loaned £100, the interest charged being at the rate of 5 per cent. The bank held collateral security. The company was registered on May 25th, 1923, and apparently had made no profits since the commencement. During the half-year to August, 1923, the overhead charges were £2,031 on a turnover of £4,800, and there was a net loss of £1,036. During the half-year to February last the sales fell to £3,460, the overhead expenses were £1,700, and there was a net loss of £2,031. No detailed accounts had been prepared since February, but it was believed that during the interval no further losses had been incurred. Since the appointment of the liquidators the expenses had been cut down, but sufficient hands had been employed for the purpose of finishing the outstanding contracts. It was necessary for those contracts to be completed, otherwise claims for breach might have arisen. The directors had drawn no salaries or fees. The nominal capital of the company was £5,000, of which £3,400 had been issued and was fully paid. No resolutions were passed by the creditors, and consequently the voluntary liquidation of the company will be continued with the liquidators appointed by the shareholders. The principal creditors are:—

	£		£
General Electric Co., Ltd. ...	322	Hirst, Ibbotson & Taylor ...	181
Henry George & Co., Ltd. ...	170	Liverpool Electric Cable Co.,	
Ward & Goldstone, Ltd. ...	114	Ltd.	102
Thompson & Co.	225	Wholesale Fittings Co.	134

THE METROPOLITAN ELECTRIC WIRE CO., LTD., 48, Bayham Place, Camden Town, N.W.—The first meeting of the creditors and shareholders of this company (in liquidation) were held on July 1st before Mr. E. T. A. Phillips, Official Receiver, at the London Bankruptcy Court. A statement of affairs was submitted showing liabilities of £3,160 against assets valued at £792, and a total deficiency of £4,169 as regarded contributories. The chairman reported that the company was registered in January, 1923, with a nominal capital of £500, and was formed to carry on business as manufacturers of and dealers in electric wire and accessories used in the manufacture of electrical appliances. In May, 1923, the capital was increased to £5,000. The failure of the company is attributed to insufficient working capital and expensive experimental work which proved abortive. In the opinion of the Official Receiver the company's affairs had been grossly mismanaged. The liquidation was left in the hands of the Official Receiver.

FILM COOLING TOWERS, LTD., 124, Chancery Lane, London, W.C.2.—As announced in our issue of May 30th, p. 877, this company is in voluntary liquidation. Mr. K. W. Branczik, formerly manager and chief engineer to the company, who was appointed liquidator, informs us that he is carrying on the business of the company with a committee of inspection. A meeting of creditors was held on June 5th.

LONDON WIRELESS CO., LTD.—Winding up voluntarily. Liquidator, Mr. V. McDonnell, 1, Dolby Road, Fulham, S.W.6. A meeting of creditors was called for July 11th at Anderton's Hotel, Fleet Street, E.C.

HONG KONG TRAMWAYS CO., LTD.—A meeting of members is called for July 31st at 3, Lombard Street, E.C., to hear an account of the winding up from the liquidator, Mr. E. R. Morriss.

Dissolution of Partnership.—HOLDEN & PICKUP, electrical engineers, 24, High Street, Oldham.—Mr. J. Holden and Mr. A. R. Pickup have dissolved partnership. Mr. Holden will attend to debts.

Trade Announcements.—Messrs. J. J. EASTICK & SONS, of 2, St. Dunstan's Hill, E.C.3, have installed an additional telephone, and their numbers are:—"Central 7571," "Royal 2217"; Works: "Dalston 1912."

MESSRS. GOWAN BROS., electrical engineers and contractors, of 1, Amersham Hill Avenue, Amersham, Bucks, announce that their business will in future be carried on by Mr. T. Budgett and under his name.

MESSRS. HARWELL, LTD., of 28, John Street, Theobalds Road, London, W.C.1, have been appointed sole agents, for the British Empire, of the Porcelain Works of Messrs. L. Pohl, Tellnitz, Czecho-Slovakia.

MR. W. W. MARTIN, has retired from the firm of Martin and Mitchell, electrical engineers and contractors, of Kidderminster, and the business will be continued by Mr. JOHN A. MITCHELL, who will attend to debts, &c.

MR. H. I. LEWENZ, M.I.Mech.E., M.I.E.E. (who recently resigned his appointment with Messrs. Vickers, Ltd.), and Mr. J. W. WILKINSON, A.M.I.E.E., M.A.Min.E.E., electrical power engineer, late of 12, Tavistock Street, W.C., have formed, and become managing directors of a private company known as LEWENZ & WILKINSON, LTD., with offices at 25, Victoria Street, S.W. The new firm will be principally concerned with industrial power plant and equipment.

MR. ARTHUR COZENS, electrical engineer and contractor, of Ascot, and Camberley, is opening new showrooms and offices at 7, High Street, Clacton-on-Sea, in charge of Mr. F. W. Allum. Catalogues are desired.

Messrs. FULLER'S UNITED ELECTRIC WORKS, LTD., have removed their Midland office to 5 to 9, Severn Street, Birmingham.

The ELECTRO DYNAMIC CONSTRUCTION CO., LTD., has taken more extensive premises at Malt Street, London, S.E.1.

Catalogues and Lists.—Messrs. SIEMENS BROS. & CO., LTD., Woolwich, S.E.18.—Pamphlet 60A, containing 30 views of the company's Woolwich works.

THE MULLARD RADIO VALVE CO., LTD., Nightingale Lane, Balham, S.W.12.—List No. V.S.2, illustrating and describing silica-envelope valves for high-power transmission and rectification.

THE SUN ELECTRICAL CO., LTD., 118 & 120, Charing Cross Road, W.C.2.—Illustrated and priced pamphlets dealing with "B.T.H." radio valves and the "Revo" loud speaker.

MESSRS. F. C. HEAYBERD & CO., 9, Talbot Court, Eastcheap, E.C.3.—A price list of testing sets and laboratory instruments of various makes.

ELECTRIC CONTROL, LTD., Empire Works, Bridgeton, Glasgow.—Leaflet 12H/X, illustrating installations of "Empire" automatic control equipment.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—Publications Nos. 535 and 536, illustrating and describing, respectively, a three-high plate mill at a Scottish steel works and a 15,000-h.p. water turbine.

MESSRS. J. HOPKINSON & CO., LTD., Britannia Works, Huddersfield.—An illustrated brochure describing the company's exhibits at the British Empire Exhibition.

THE BILLING TOOL CO., 303, High Holborn, W.C.1.—An illustrated pamphlet giving details and prices of bench drilling, &c., machines.

THE BRUSH ELECTRICAL ENGINEERING CO., LTD., Falcon Works, Loughborough.—Leaflet 200-5-1, describing a h.p. oil-immersed tapping switch for transformers.

SWITCHGEAR & COWANS, LTD., Old Trafford, Manchester.—Descriptive Circular No. 27-1, dealing with the company's exhibits at the British Empire Exhibition, and a booklet illustrating many examples of its switchgear.

SWITCHGEAR & ELECTRICAL PRODUCTIONS, LTD., Excelsior Works, Ellis Street, Birmingham.—A priced and illustrated pamphlet advertising the firm's time switch.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38 & 39, Upper Thames Street, E.C.4.—July price list of electrical materials, accessories, and appliances.

THE LANCASHIRE DYNAMO & MOTOR CO., LTD., Trafford Park, Manchester.—A wallet containing a number of illustrated leaflets describing the company's exhibits at the British Empire Exhibition.

BURWOOD ELECTRICAL SUPPLIES CO. (1924), 41, Great Queen Street, W.C.2.—An illustrated net price list of electrical supplies, and a similar list dealing with radio sets and accessories.

THE EVER-READY CO. (GREAT BRITAIN), LTD., Hercules Place, Holloway, N.7.—A comprehensive catalogue of dry batteries and accumulators for various purposes. Priced.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—Pamphlet No. 230, containing fully-illustrated particulars of Marconi commercial service radio receivers and accessories. A number of actual installations are dealt with.

ELECTRICAL UTILITIES, LTD., Tudor Works, Park Royal, N.W.10.—Leaflet R, illustrating and describing "Utility" electrical relays. Priced.

An Oversea Market for Wireless Apparatus.—Reports on the market for wireless apparatus in the Dominican Republic and Hayti have been prepared by the Department of Overseas Trade from information received from the Department's representatives at Santo Domingo and Port-au-Prince.

Australian Notes.—Newspaper reports just to hand state that Sir Sam Fay, Sir Vincent L. Raven, and the other commissioners from England who are investigating and reporting upon the working of the New South Wales railways and tramways, arrived at Sydney on May 8th. They first made a tour of inspection of the system to get the atmosphere, and the report was expected to be in the hands of the Government within three or four months.

Sydney City Council Electricity Supply Committee agreed, on May 5th, on the recommendation of Mr. Mackay, the general manager, to send a deputation to the Government asking for a clause to be included in the Sydney Corporation (Amendment) Bill, giving the Council power to license electricians or electrical contractors employed in making connections with the electricity supply system, in order to prevent faulty work and fittings being put in.

Private Arrangements.—W. T. RAWCLIFFE, Salford, Manchester, wholesale electrical suppliers.—The creditors interested herein were called together recently at Manchester, when a statement of affairs was submitted by Mr. F. G. Gilliat, accountant, of Manchester, the receiver for the debenture holders, which showed liabilities to unsecured creditors £4,783. The assets consisted of furniture and fittings, £250; stock in trade, £2,125; book debts, £3,788, valued at £3,630; and cash in hand, deposits, &c., £42. The total assets there-

fore amounted to £6,047, from which £1,861 had to be deducted for debentures, leaving net assets of £4,185, or a deficiency as regarded the unsecured creditors of £597. The Receiver stated that the business was previously a private partnership which ran for about 12 months, when it was turned into a limited company. One of the directors guaranteed an overdraft at the bank and took debentures in July, 1923, to cover his guarantee, the debentures being for £1,861. For the year to September, 1921, on a turnover of £11,000, there was a loss of £528. In the following year there was a further loss of £860, while for the 12 months to September, 1923, on a turnover of £11,800, there was a loss of £1,071. It was suggested that the business should be continued by the Receiver and the creditors' claims discharged out of future profits. Eventually it was decided that a committee of inspection should be appointed with power to carry on the business for three months, after which a further meeting of creditors would be called to consider the position.

ROBERTSON & SON, ironmongers and electrical engineers, 86, George Street, Edinburgh. A meeting of the creditors of the above was held recently, when a statement of affairs was presented which showed liabilities of £6,017, made up as follows: trade creditors, £3,287; cash creditors, £1,863; and bank overdrafts, £866. The assets were estimated to realise £4,997, from which had to be deducted £176 for preferential claims, leaving net assets of £4,820, or a deficiency of £1,196. The assets consisted of: book debts, £1,567, estimated to realise £1,175; stock on hand £5,271, expected to produce £3,500; working tools, furniture, &c., valued at £300; and cash in hand £22. The estate showed a dividend of 16s. in the £, subject to the expenses of realisation. It was reported that the business had been carried on by the late Mr. Robertson, and the testamentary trustees, acting on behalf of the widow and family, had granted a trust deed in favour of Mr. Brown, accountant, of Edinburgh. Accounts had been prepared covering the last three months, and they showed that during that period there had been a profit on the trading of about £500. During the discussion which took place it was suggested that a composition of not less than 15s. in the £ might be paid, and a committee of three of the creditors was appointed to consider the matter with a view to a proposal being submitted to an adjourned meeting of the creditors. The committee appointed consisted of the representatives of Messrs. Wood & Cairns, Alexander Dougall & Sons, and Aikman & Co.

Catalogues Wanted.—MESSRS. PENEAST & Co., of Archer Works, Archer Street, Piccadilly, London, W.1, ask for catalogues of high-power wireless sets, small lighting sets, and accessories.

New Belgian Company.—La Société des Marteaux Electro-mécaniques système Georgevitch (Margeo) has been formed at Ixelles (40, Rue Crespel) with a capital of 2½ million fr., to acquire the European and Colonial (except Great Britain) rights in the Nicholas Georgevitch patents relative to the manufacture of electro-mechanically-operated centrifugal hammers.

Chambers of Commerce Congress.—The tenth Congress of Chambers of Commerce of the British Empire was opened at Guildhall on July 1st. The Lord Mayor and the Colonial Secretary, on behalf of the Government, welcomed the Congress to London. Lord Derby delivered his presidential address, and Mr. H. L. Symonds (London) moved a resolution calling on the Government to take immediate steps to remove the difficulties which obstructed the establishment of an efficient radio-telegraph service within the Empire. He said that the exact method was one for the Government or for the Imperial Parliament. His suggestion would be a reference to arbitration, as in the case of the inland telegraph service 50 years ago, as to a cash payment by way of commutation of all claims. The question of *personnel* could only be dealt with by a scale of payment in Government service at least as liberal as that accorded by private enterprice. Sir E. Holberton (Bengal) seconded the resolution, and urged the importance to India of direct communication. Sir Hugh Denison (Sydney) said that if an agreement could not be arrived at, the Government should put up a station of its own. The resolution was carried.—*The Times.*

According to the *Financial Times*, Sir Edgar Holberton (Bengal) is reported as having moved a resolution urging the abolition of the system of triple rates now charged for foreign "urgent" cables. Such facilities for rapid communication were not essential from the business point of view. Business firms used them because they knew that their rivals would. In the case of Europe he understood that a considerable portion of the profits went to the Post Office, but as regards foreign cables the whole of the profit went, not to the relief of the taxpayers, but into the coffers of the cable companies. The resolution was carried.

Swedish Motors for India.—It is stated by *Commerce Reports* that contracts for approximately 20,000 h.p. of electric motors, for use in cotton mills owned by the Sassoon interests in British India, have been awarded to the Allmanna Svenska Elektriska Aktiebolaget.

The Factories Bill, 1924.—The issue of the *Bulletin* of the Federation of British Industries for July 1st contains an eight-page summary of this Bill, picking out the proposed new and altered provisions. The measure is one of great importance to industrial concerns, and this summary should be of considerable service. The Federation recently appointed a special committee to consider the Bill, and the views of all members are being invited.

For Sale.—By direction of the George Cohen & Armstrong Disposal Corporation, Messrs. Bradshaw, Brown & Co. will sell by auction, on July 21st, at Wood Lane, Shepherd's Bush, plant, machinery and electrical equipment, including generating sets, electric motors and generators, transformers, &c. (See our advertisement pages to-day.)

Electricity in the Architect's Home.—"Electrical homes for electrical men," reads the slogan, the theory being, of course, that the man who uses electrical equipment himself will be able to urge its use by others more sincerely and more convincingly. A similar slogan might be a very useful one in connection with the electrical education of the architect. Much has been said in the past of the necessity of convincing the architect of the advisability of installing electrical conveniences in the modern home—articles have been written for architectural magazines, addresses have been made before architectural gatherings, and calls have been made upon the individual men in their offices. But the architect is rightly a conservative. He hesitates to recommend to his client anything which he regards as still in the experimental stage, however great its advantages—and in consequence often omits electric refrigeration, cooking equipment, and air heating in homes which could well afford the comfort and cleanliness of these conveniences. Why not try reaching the architect in his own home? If his own house is provided with an electric ice machine and he has the testimony of his wife in regard to its success and economy, he will have the confidence of knowledge in recommending it to others. The electrical industry might well consider ways and means of facilitating the purchase and installation of electrical equipment by the architectural profession. Why not the slogan, "Modern homes (which means, of course, electrical homes) for architects"?—*Journal of Electricity*, San Francisco.

An American View of Europe.—Mr. Anson W. Burchard, president of the International General Electric Co., has just returned to the States after a visit to Europe. The *Electrical World* says that he finds that electrical manufacturing companies in Europe, particularly France and Italy, are doing much better business relatively than other principal lines of industry, and the electrical outlook abroad is good. Considerable hydro-electric work is in progress in Italy and Southern France. Subsidiaries of the International General Electric in England, France and Italy are operating at capacity, and have enough orders to keep them busy for the rest of the year. "British and French concerns, however, are providing strenuous competition. There is much activity in the radio field in England, and British companies are doing a good business manufacturing radio material. Europe has improved economically, Mr. Burchard asserts, but the political situation is unchanged."

British Empire Exhibition Notes.—Between 50 and 60 members of the Diesel Engine Users' Association and their friends paid a visit to the Exhibition on June 27th. After lunch the party split up into small groups, and the exhibits of various firms in the Palace of Engineering of special interest to users of heavy oil engines were visited.

On July 5th a recital was given by M. le Chevalier Jef Denyn upon the carillon bells installed in the clock tower of the Vickers Research Building. The recitalist, who is *carillonneur* at St. Rombold's Cathedral, Malines, played a number of well-known British and Belgian airs.

A new official guide to the Exhibition (one shilling) has been issued. It contains much information which could not be given in earlier editions and many pictures of the various buildings, also portraits of personages prominently connected with the Exhibition.

Lancashire Dynamo and Motor Co. Contracts.—A number of important orders have recently been received by the LANCASHIRE DYNAMO & MOTOR CO., LTD. Among these are the following:—For the Gas Light & Coke Company. The whole of the generating equipment for the extension of that company's Fulham gasworks, comprising generators, motors, control gear, turbines, condensing plant, and auxiliaries. The machines to be supplied are a 500-kW d.c. generator geared to an 8,000-r.p.m. turbine (generator speed 1,000 r.p.m.); a 250-kW revolving field alternator geared to a 9,000-r.p.m. turbine (generator speed 1,500 r.p.m.); and a motor-alternator set, consisting of a 250-kW self-starting synchronous motor direct-coupled to a 278-kW d.c. dynamo. The set is arranged to work in either direction, the d.c. output being 206 kW. Plant supplied to the new spinning mill of Sir John Holden and Sons, Ltd., Bolton, comprises a 500-kVA (350 b.h.p.) self-starting synchronous motor for driving the shaft for the belt-driven mules and for power factor correction; three 350-b.h.p., and four 200-b.h.p. slip-ring motors; and one 60-h.p. and two 15-h.p. squirrel-cage motors, as well as control gear and wiring.

For the Bedford Corporation the company is supplying a 4,415-kVA alternator for coupling to a 3,000-r.p.m. Allen turbine. Another alternator (1,875-kVA) is being supplied to the Crewe works of the London, Midland & Scottish Railway for coupling to a Belliss & Morcom turbine. The Swansea Corporation has given the company an order for the whole of the electrical equipment of a coal-conveying plant at its electricity works, including the motors for driving electric

truck tipplers, coal crushers, elevators, and conveyors. These motors have to start against a load equal to 2½ times full-load torque, and operate on a cycle of 2 minutes lift, 10 seconds stop, and 2 minutes run in the reverse direction.

The Rugby Wireless Masts.—In his address at the meeting of Head, Wrightson & Co., Ltd., at Thornaby-on-Tees, last week, Sir Guy Wrightson said that the most interesting piece of work that they had on hand at present was the erection of 12 masts for the General Post Office. Each of these masts was 820 ft. high, and they were already a landmark to all passing in the neighbourhood of Rugby. This was the first link in the Imperial Wireless Chain. They had an exhibit of a model of the mast in the Post Office Section of the Government Pavilion at Wembley.

Exhibitions Abroad.—British manufacturers of mining and metallurgical machinery are offered free space for the exhibition of their products at the Lima, Peru Exhibition of Mining Industries in December next. The Consul-General for Peru, 36 & 37, Queen Street, E.C.4, will answer communications.

The Federation of British Industries recently stated in its *Bulletin* that the British Empire Exhibition had proved a very serious obstacle in the way of enlarging the size of the F.B.I. British Section at the Canadian National Exhibition at Toronto at the end of this summer. Many firms interested in the Canadian market are so heavily committed this year at Wembley that any extension of their operations is quite impossible. The Federation site, however, is 5,000 sq. ft., against about 3,000 last year.

New French Companies.—La Société de la Manufacture Moderne de Fils Electriques et d'Isolants has been formed in Paris (20, Boulevard Montmartre) with a capital of one million fr.

La Société Rurale de Distribution d'Electricité has been formed in Paris with a capital of four million fr., to acquire and exploit the patents of M. Maurice Lorfeuvre, relative to the automatic regulation and control of hydro-electric stations from a distance.

Carbon Imports to Austria.—It is no longer necessary to obtain licence permits for the importation of carbons for electrodes into Austria.

Lamp Price Reductions in the States.—The General Electric Co. announces that on July 1st it will reduce the prices of its incandescent lamps by approximately 10 per cent. throughout the United States. This reduction brings lamp prices to 37 per cent. below the 1914 figures.—*Reuter's Trade Service* (New York).

E.D.A. Activities.—"When Summer Comes" (E.D.A. 463) is a new pamphlet published by the British Electrical Development Association. It deals with the electric fan in an appropriately breezy manner, with an illustrated front cover in the same spirit.

Proposed Norwegian Tariff Revision.—The proposals for revised tariffs on imports into Norway, reproduced in the July 3rd issue of the *Board of Trade Journal*, include the alteration of the duties upon electric cables and other wires. For wires weighing up to 100 gr. per metre the duty proposed is 35 kr. per kg., and for cables weighing more than this 10 kr. per kg. The new rates will be lower in some cases. If the cables are such as cannot be made in Norway they may be admitted free of duty.

The Canadian General Electric Company.—A *Reuter* dispatch from Peterboro', Ontario, states that as a result of having been granted a fixed assessment for a number of years on its properties there, the Canadian General Electric Co. announced last month its intention of immediately constructing a large addition to its plant, costing approximately $400,000. The extension, it is expected, will be completed this year.

Book Notices.—Publications of the United States Bureau of Standards.—Technologic Papers No. 254, "Emissive Tests of Paint for Decreasing or Increasing Heat Radiation from Surfaces" (5 cents); No. 255, "A Camera for Studying Projectiles in Flight" (10 cents); and No. 256, "Some Methods of Testing Radio Receiver Sets" (10 cents); also Circular No. 155, "United States Government Master Specification for Coal-tar Pitch for Waterproofing and Damp-proofing" (5 cents). Washington: Government Printing Office.

"Vibration in Engineering," by J. Frith and F. Buckingham. Pp. xiv +123; figs. 41. London: MacDonald & Evans. Price 7s. 6d. net.

"Coal and Oil Fired Boilers," by Engineer-Comr. F. J. Drover, R.N. Pp. xiv+350; 191 figs. London: Chapman and Hall, Ltd. Price 16s. net.

Reid's Handy Colliery Guide and Directory for the Counties of Northumberland, Durham, Yorkshire, Cumberland, and Westmorland. Newcastle-on-Tyne: Reid & Co. Price 3s. 6d., post free.

The Pacific Cable Board, Queen Anne's Chambers, Tothill Street, S.W.1, has issued a booklet, describing the constitution, working, and other matters connected with the Board, under the title "The All-Red Route, *vid* Pacific." The publication is illustrated by a number of excellent photographic views.

"Science Abstracts (A and B)." Vol. XXVII. Part 6. June 25th, 1924. London: E. & F. N. Spon, Ltd. Price 3s. each, net.

"The *Journal* of the Junior Institution of Engineers," July, 1924. London: Percival Marshall & Co. Price 2s.—This issue contains, amongst other matter, reproductions of the following two papers:—"Methods of Purifying Water and Sewage," by F. W. Follett; "Developments in Machine Tools and Factory Installations," by T. W. Thompson.

"Electricity Supply in War Time, as Affected by the Improvements in Heavy-oil Engines," by A. H. Dykes, M.Inst.C.E., M.I.E.E., and W. T. Townend, R.N. London: Diesel Engine Users' Association. Price 7s.—A paper read before the Association, with report and discussion.

Electrical Trade of the Netherlands.—One of the totals in the note which appeared under the above heading in our issue of June 27th (p. 1042) was given incorrectly in the Commercial Secretary's report. The total imports of "(*a*) Electrical apparatus and instruments not mentioned under (*b*) and (*c*)" should have been given as 929,000 fl., instead of 810,000 fl.

Sydney Municipal Contracts.—At the Sydney City Council meeting on May 13th the vice-chairman of the Electric Supply Committee was to move "That a representative of the City Council duly located in London should be entrusted with the responsibility of purchasing supplies and material generally for use in the electricity supply undertaking." This motion was the outcome of the committee of inquiry that was investigating allegations regarding the system adopted by the Sydney firms in tendering for supplies of plant and machinery.

A proposal was to come before the Sydney City Council early in May that opinion of senior counsel be obtained on the question of whether any of the electrical firms who engaged in the "consolation system of tendering" to the City Council committed a legal wrong. According to the *Sydney Daily Telegraph* the committee was informed that, according to counsel's opinion, these firms had not contravened any of the regulations of the Australian Industries Preservation Act. The committee decided to recommend the acceptance of a tender higher than one submitted by one of the firms in question. The committee took the view that it could not go on in this way, punishing the council as well as the contractors, and for that reason counsel's opinion was sought. The city solicitor already had reported that, in his opinion, the action of these firms was not illegal.

Electrical Trade in South Africa.—In its report for June, the Standard Bank of South Africa states that the engineering and electrical trades report greater activity and fairly satisfactory returns.

Aluminium Prices on the Continent.—Contrary to certain German newspaper statements as to an alteration in the price of crude aluminium, a Berlin report announces that no change in prices has taken place. Merchant qualities still remain at from 2.92 fr. per kg., up to 3.02 fr. per kg., according as the quantities range from 50 tons down to 15 tons and under, although a rebate of 5 centimes is allowed for ingots. It is added that a meeting of the members of the International Aluminium Convention will take place in the near future, but it is not known whether the conference will make any alterations in prices.

Indian Patent Applications.—According to a report recently issued by the Indian Patent Office, only 1,065 applications for patents were received in India during last year, as compared with 1,117 in 1922. Of the total, 810 of the applications came from abroad, while 255 were applied for in India.

British Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned. In the case of foreign applications the names and addresses of the British representatives are also given:—

Rai Wire (lettering and design). No. 445,502. Class 5.—Copper wires. Compagnie Générale d'Electricité, 54, Rue de la Boetie, Paris. (Cruikshank & Fairweather, 65-66, Chancery Lane, London, W.C.) July 2nd, 1924.

Flexlume. No. 440,679. Class 8.—Electrically-illuminated signs. Flexlume Corporation, 74, Kail Street, Buffalo, N.Y., U.S.A. (White, Langner, Stevens & Parry, Jessel Chambers, 88-90, Chancery Lane, London, W.C.) July 2nd, 1924.

Bico (lettering and design). No. 447,188. Class 8.—Electrical accumulators and batteries (not medical). The Briscoe Importing Co., Ltd., 9, Anstons Quay, Dublin. July 2nd, 1924.

Efesca (lettering and design). No. 447,499. Class 8.—Instruments for wireless telegraphy and telephony. Falk, Stadelmann & Co., Ltd., London, E.C.1. July 2nd, 1924.

The Mighty Atom. No. 448,260. Class 8.—Instruments and apparatus for use in wireless telephony. Jose Marcel Ortega, Sicilian House, Sicilian Avenue, London, W.C.1. July 2nd, 1924.

Ella. No. 448,571. Class 8.—Wireless telephonic and signalling instruments. Lionel Robinson & Co., London, W.C.1. July 2nd, 1924.

Hicks. No. 434,968. Class 8.—Hydrometers, magnetographs, and other instruments. W. F. Stanley & Co., Ltd., London, W.C.1. June 25th, 1924.

Wandsworth. No. 445,972. Class 8.—Electric meters and electrical switchboards (fitted). No. 445,973. Class 13.—Electrical goods made wholly or partly of metal, including switches, switch boxes, switch cover plates, bell pushes, switch plugs, wall and floor plugs and sockets, &c. No. 445,974. Class 16.—Electric insulators made of pottery or earthenware. Wandsworth Electrical Manufacturing Co., Ltd., Birmingham. June 25th, 1924.

The Brownie Wireless. D.L.5 crystal and "Palladium" catwhisker (lettering and design). No. 445,868. Class 8.—Detector crystals and catwhiskers for use in wireless telephony and telegraphy. James W. Barber, trading as the J.W.B. Wireless Co., 4, Park Crescent, Portland Place, London, W.1. June 25th, 1924.

Brunite. No. 446,476. Class 8.—Crystal detectors for use in wireless telegraphy and telephony. Ben Wilson, trading as B. Wilson & Co., 356, Hornsey Road, London, N.19. June 25th, 1924.

Trix. No. 446,580. Class 8.—Instruments and apparatus for use in wireless telegraphy and telephony, but not including electric dry cells and batteries or like goods. The firm trading as Eric J. Lever, 33, Clerkenwell Green, London, E.C.1. June 25th, 1924.

Morris. No. 439,219. Class 22.—Platform trucks propelled by electric batteries, &c. Herbert Morris, Ltd., Loughborough. July 2nd, 1924.

Wages in the Tramway Industry.—The Joint Industrial Council for the Tramway Industry is to meet to-day (Friday) to consider the application of the employés for increased wages, standardisation, and stabilisation.

Lighting and Power Notes.

Argentina.—ELECTRICAL DEVELOPMENT.—Steady progress is reported by the Société d'Electricité de Rosario, which is now supplying electricity to 29,810 consumers, an increase of 2,516 during the past year. The output of the company's generating plant advanced from 38,273,500 kWh in 1922 to 43,457,700 kWh in 1923. In view of the fact that the population of Rosario is steadily advancing, a further increase in the demand for electricity is anticipated, to meet which orders have been placed for a 15,000-kW turbo-generator and for four new boilers.

Bath.—LOAN.—The Electric Lighting Committee has decided to apply to the Electricity Commissioners for sanction to a loan of £8,746 for an e.h.p. main to the city boundary in connection with the supply of electricity outside the borough, for which a Special Order has been obtained.

Barford.—SPECIAL ORDER.—The Barford Electric Supply Co., Ltd., is applying to the Electricity Commissioners for a Special Order authorising it to distribute electricity within Barford and certain parishes in the rural districts of Warwick, Brailes, Stratford-on-Avon, and Southam.

Burnley.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (borough electrical engineer, Mr. J. E. Starkie) for the year ended March 31st last shows a total income of £85,708, as compared with £90,439 in the previous year. Working expenses amounted to £40,118, as against £45,628, and the Electricity Commissioners' inquiries *re* the North-East Lancashire electricity district and the new power station near Padiham accounted for £2,196, leaving a gross profit of £43,393 (£45,342). After deducting capital charges there was a net surplus of £19,895, as compared with a profit of £21,800 in 1922-23. During the year £13,928 was spent on capital account, and the amount now expended on the undertaking amounts to £344,032. The electrical energy sold totalled 8,068,242 kWh, an increase of 258,245 kWh. The laying of a 33,000-V feeder from the power station to Rosegrove is now being proceeded with, and may be considered as part of the system of interconnection in accordance with the Mid-Lancashire Electricity District Order. For supplying the district of Royle Road with energy for power purposes a new 6,600-V feeder is to be laid. An all-round reduction in the charges for electricity was made in April of last year, and a further reduction was made in the charges for heating and domestic purposes in December last.

An inquiry was held in February last into the applications of the Corporation and the Lancashire Electric Power Co., for sanction to erect a power station near Padiham, which resulted in the Commissioners giving their consent in favour of the company.

Colne.—LOAN SANCTIONED.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £5,900 for mains and services.

China.—SHANGHAI.—Enlargement of its present electric power plant to a capacity of 10,000 kW is being contemplated by the French Tramway & Electric Light Co. About half of the proposed increase is to be put in during 1924, and the remainder during 1925. An improvement to the street car system is also planned, involving the double tracking of Avenue Joffre from Route Voyron to Route Say Zoong.—*Commerce Reports.*

Continental.—JUGO-SLAVIA.—The Italian Consul at Uskub reports that a company has been formed, under the style of the Tetovo Commercial and Industrial Co., to harness the watercourses in the neighbourhood of the city of Tetovo. Local banks and also the municipality are financially interested in the scheme. The generating station will have a capacity of 3,000 h.p. during the greater part of the year. Jugo-Slav, Austrian, Czecho-Slovak, and German firms have already sent technical experts to make surveys in order to present their schemes and tenders. The estimated outlay is between 8 and 10 million dinars.—*L'Elettrotecnica.*

FRANCE.—Le Syndicat Inter-communal pour l'Electrification de la Region Avallonnaise, of Avallon, has secured the concession for the supply of electricity to 91 communes in the Department of Yonne.

La Société Lorraine de Distribution du Gaz et d'Electricité has applied for the concession to supply electricity in 59 communes in the Department of Moselle.

BELGIUM.—The Société des Charbonnages de Winterslag, of Winterslag, is increasing the capacity of its electricity plant by the addition of a new 4,800-6,000-kW turbo-generator.

Dalkeith.—PROPOSED PURCHASE OF UNDERTAKING.—The Lighting Committee has requested the Electric Supply Corporation, Ltd., to state if it will sell parts of its undertaking by agreement. Engineers have been instructed to report as to the cost of changing over the system of supply from d.c. to a.c., and to further investigate as to the condition of mains, &c.

Dundee.—SYSTEM OF SUPPLY.—The Corporation is applying to the Electricity Commissioners for leave to supply single-phase alternating current at 200 V and 3-phase at 346 V, 50 cycles, from a 3-phase, 4-wire distribution system, and in those areas where it is found desirable to change over the present d.c. system.

Guildford.—OPPOSITION TO ORDER WITHDRAWN.—The Rural District Council has withdrawn its opposition to the application of the Leatherhead Electricity Supply Co. for an Order to supply electricity to the parishes of East and West Horsley and East Clandon.

India.—RANGOON.—According to *The Times Trade and Engineering Supplement*, the Rangoon Electric Supply and Tramway Co. has decided to carry out considerable additions and alterations to its plant and machinery. The electricity supply is to be extended some ten miles northwards of the present area. Alterations are being made at the power station, and a change in the voltage is in progress. The original plant is to be replaced with modern sets of larger capacity. When the changes are complete, the station will have a capacity of 13,000 kW. To overcome the difficulty resulting from serious shoaling along the bank of the river on which the station is situated, measures are in hand to construct a new pumping station at a site 1¼ miles higher up, and to lay the necessary piping to connect it with the station. It is proposed to increase the pressure from 2,300 to 6,600 V. It is expected that it will take at least two years to complete the work. An agreement is being entered into to supply the new military cantonments at Mingaladon, and arrangements have been concluded with the municipality to light the streets of Insein. The necessary e.h.p. feeder cables are now being laid, and it is expected that a partial supply will be available by the end of this year in the new area.

Ipswich.—ELECTRICITY EXTENSIONS.—The Town Council is to construct a further section of the h.p. ring main to the Stoke district, with a sub-station in the Willoughby Road district. The h.p. main from the electricity works to the sub-station will be extended to give a supply to the works of a large consumer, with whom arrangements have been completed. The estimated cost of the scheme is £16,708. It is also proposed to give an additional supply to the Butter Market district at an estimated cost of £5,000.

Lancaster.—ELECTRICITY SUPPLY.—The electrical engineer has been instructed to make a survey of the district and prepare a report on the supply of electricity in the Lune Valley as far as Bentham (15 miles) and to Carnforth (6 miles).

Liverpool.—LOAN.—The Electricity Committee has recommended to the City Council that application be made to the Electricity Commissioners for sanction to the borrowing of £200,000 for mains.

London.—ST. MARYLEBONE.—*Year's Working.*—The report on the working of the borough electricity undertaking (electrical engineer: Mr. C. H. Smith) for the year ended March 31st last records a total income of £406,226, as compared with £383,487 in the previous year. Working expenses totalled £232,018, as against £212,061, leaving a gross profit of £174,208 (£171,426). Of this amount, capital charges absorbed £141,554, leaving a net surplus of £32,654, as compared with a surplus of £37,236 in 1922-23. The expenditure on capital account during the year amounted to £143,103, mainly in connection with the plant extension scheme, and the total now spent on the undertaking is £2,648,975. The electrical energy sold amounted to 43,770,345 kWh, an increase of 7,949,776 kWh, and the number of consumers connected increased by 872 to 15,012. The capacity

of the plant installed remained at 33,000 kW, but it is expected to be increased before the autumn by the addition of a 12,500-kW set, which is on order. A 1,500-kW rotary converter has been installed at Aybrook Street sub-station, and a 2,000-kW set added at Rathbone Place sub-station. Two 2,000-kW converters are now in course of installation at the generating station. The reductions during the year in the flat rate tariff from 6½d. to 5½d. per kWh, and for prepayment supplies from 7d. to 6d. per kWh represented a decrease in revenue of £17,000, and the total reductions to consumers during the post-war period have amounted to approximately £200,000.

Maidenhead.—SALARIES.—The Town Council has adopted the following scale of salaries of electricity officials as from April 1st, 1925:—Assistant engineer, £312, plus 5s. for each new consumer connected during the previous year; plus 8s. per £100 of the gross profit of the previous year; maximum £450 per annum. Station superintendent, £312, plus 5s. per kW increase in the maximum load recorded in the previous year; plus 8s. per £100 of the gross profit of the previous year; maximum £400 per annum. Chief clerk, £210, plus 5s. for each new consumer connected during the previous year; plus 4s. per £100 of the gross profit of the previous year; maximum £300 per annum. Bonuses are to be paid forthwith as under:—Assistant engineer, £25; station superintendent, £25; chief clerk, £15—these being in respect of this year and the same as paid last year.

Maidstone.—EXTENSION OF SUPPLY.—The Rural District Council has consented to the application of the Maidstone Corporation for an Order to extend its area of electricity supply to Barming, Bearsted, Linton, Loose, Teston, and West Farleigh, and has asked the Corporation to include in the new area the parishes of Otham, Hunton, and Yalding.

Norwich.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (city electrical engineer: Mr. F. M. Long) for the year ended March 31st last show a total income of £149,777, as compared with £141,472 in the previous year. Working expenses increased by £4,695 to £84,938, leaving a gross profit of £64,833 (£61,229). After deducting capital charges, there was a net surplus of £32,876, as compared with a profit of £31,394 in 1922-23. The electrical energy sold amounted to 17,159,078 kWh, an increase of 2,646,164 kWh. During the year considerable progress has been made in converting the supply in the outlying parts of the city from direct to alternating current. New mains have been laid, and the total length of distributing mains is now 88 miles.

Okehampton.—PURCHASE OF UNDERTAKING.—It is reported that the undertaking of the Okehampton Electric Light Co. has been purchased by Messrs. W. G. Heath & Co., of Plymouth. Some months ago the Council offered to purchase the undertaking.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

HORSHAM.—Lighting and power: A reduction of ½d. per kWh.

KENDAL.—Heating and power: From 4d. to 3d. per kWh.

BATH.—Lighting: From 7d. to 6½d. per kWh. Power and heating: From 1½d. to 1¼d. per kWh.

Richmond (Yorks.).—ELECTRICITY SCHEME.—The Town Council has received a report by Mr. A. G. Pine, consulting engineer, on the proposal to introduce electricity into the district. The scheme proposed would cost £15,000, and Mr. Pine suggests that the charge should be 8d. per kWh for lighting and considerably less for power.

Ruskington.—PROPOSED ELECTRICITY SCHEME.—The Urban District Council on June 21st considered an electric lighting scheme submitted by Mr. A. Anderson. The scheme provides for utilising the existing water-pumping house, and the total cost, with underground mains, is estimated at £4,970, and with overhead mains at £3,550. The Council decided to defer consideration of the scheme for a year.

Sunderland.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (engineer: Mr. A. S. Blackman) for the year ended March 31st last shows a total income of £144,851, as compared with £129,389 in 1922-23. Working expenses amounted to £76,955, leaving £67,895 to be carried to the net revenue account. Of this, £17,918 is required for interest on capital and £2,819 for income tax, leaving a surplus for the appropriation account of £46,956. This is allocated as follows:—Repayment of loans, £33,041; depreciation of stock, £905; depreciation and renewals fund, £8,989; alterations to stores and offices and equipment for new showrooms, £4,000. The capital outlay on the undertaking now amounts to £861,926. Loans repaid amount to £429,750, and loans outstanding to £353,582. Revenue contributions to capital total £14,059. The output last year amounted to 18,742,066 kWh, an increase of 3,423,104 kWh, but 11 per cent. below the 1921 output. Over 250 new consumers have been connected during the year. A general reduction of tariffs has been arranged, which will represent an estimated decrease in revenue of over £11,000. Work is proceeding with extensions to the generating plant and to mains, which will cost £196,000, towards which a grant is being made by the Unemployment Grants Committee.

Tamworth.—ELECTRICITY SCHEME.—The Electricity Committee has conferred with representatives of the Pooley Hall Colliery Co., Ltd., on the proposal of the company to provide the necessary capital for carrying out the electricity scheme for the borough. The Committee recommended that the proposal of the company to provide the whole of the capital and contract with individual householders for a supply of electricity be endorsed, and that on the receipt of the Commissioners' sanction to the borrowing by the Corporation of the capital cost the Council should itself take over the scheme at any time after the expiry of four years from the signing of the formal contract with the company. The report was adopted by the Council.

Taunton.—SPECIAL ORDER.—The Town Council has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the parishes of Trull, St. James' Without, Staplegrove, St. Mary Magdalene Without, and Bishop's Lydeard.

Tickhill.—ELECTRICITY CHARGES.—The Yorkshire Electric Power Co., which is about to supply electricity to the district, has informed the Urban Council that the charges for electricity will be as follows:—Lighting: A flat rate of 6½d. per kWh, with alternative rates for long-hour users. Small power consumers: A sliding scale from 3½d. per kWh to 2.4d. There will also be a combined tariff for lighting, heating, and cooking for residential users, and a separate tariff for kinemas.

Venezuela.—HYDRO-ELECTRIC SCHEME.—The Siemens-Schuckert Co., of Berlin, has submitted a scheme for the establishment of a new hydro-electric power station on the Caruao River to supply electricity to the capital city of Caracas. It is proposed to install three turbo-generators with a total capacity of 7,000 h.p.

Wimbledon.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (borough electrical engineer: Mr. A. E. McKenzie) for the year ended March 31st last records a total revenue of £107,826, as compared with £99,965 in 1922-23. Against this was charged a working expenditure of £50,625, as against £49,239, leaving a gross profit of £57,201 (£52,726). Capital charges absorbed £26,793, and there was a net surplus of £30,408, as compared with £28,702 in the previous year. A total of £54,356 was spent on capital account during the year; this included £24,263 for machinery and £17,853 for mains and services. The total sales of electrical energy increased from 6,156,683 to 8,570,130 kWh, and the average price obtained per kWh was reduced from 3.754d. to 2.882d. A new Metropolitan-Vickers 3,000-kW turbo-alternator was brought into operation last October. A similar set has been placed on order, and is now in course of erection at the station. A new main switchboard has also been ordered for installation before next winter.

Tramway and Railway Notes.

Australia.—RAILWAY ELECTRIFICATION.—Mr. J. J. C. Bradfield, chief engineer for Metropolitan Construction and the Sydney Harbour bridge, giving evidence before the Public Works Committee recently concerning the Tempe-East Hills and Bankstown George's River railway lines, said proposals provided for electric traction on both lines. The Tempe-East Hills line would be 15 miles in length and the route mileage 10¼ miles. The estimated cost was £403,049. The Bankstown George's River line would be 3¼ miles of single line. The estimated cost was £87,114, and the electrical equipment would cost £20,000, totalling £107,114.—*Tenders.*

Birkenhead.—NEW ROUTE.—The Corporation proposes to lay a double tramway track to the borough boundary in the Bebington and Bromborough district.

Burnley.—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking (general manager, Mr. H. Mozley) for the year ended March 31st last show a total revenue of £159,893, as compared with £170,900 in 1922-23. Working expenses amounted to £123,113 (£133,400), leaving a gross profit of £36,780, from which was deducted £13, being a deficit on the motor omnibuses. The omnibus service was only in operation a few days to March 31st. This amount was distributed as follows:—Interest and sinking fund, £14,810; rent for tramways owned by outside authorities, £1,928; income tax, £4,631; purchase of property at Padiham, £300; proportion of repayment—motor omnibuses, £32; transferred to renewals fund, £15,065. The number of passengers carried increased from 21,349,624 to 21,758,743, and the number of car-miles run from 1,744,272 to 1,789,406.

Darlington.—RAILLESS CARS.—The General Purposes Committee on June 27th resolved to adopt the Electricity and Light Railways Committee's recommendation that application should be made to the Ministry of Transport for sanction to change the system of transport from electric tramways to railless-cars. A deputation which had inspected the railless-car systems at Birmingham and Wolverhampton reported that the running of railless-cars with electricity at ¾d. per

kWh appeared to be from 2¼d. to 3d. per car-mile less than the cost of running petrol 'buses with similar carrying capacity, and on the car mileage run in Darlington this would amount to about £6,000 per annum. The annual capital outlay would probably be about the same.

London.—TUBE EXTENSIONS.—An important development of the underground railways in South London is about to be carried out in the form of extending the Hampstead Tube from its present terminus at Charing Cross to Kennington, *via* Waterloo. The new line will be about two miles in length. At Kennington the Hampstead Line will be connected with the City and South London Railway and a new platform will be built alongside each of the platforms of the latter line. It is hoped to have the Kennington extension completed by the end of next year. By that time the City and South London Railway extension to Morden, *via* Balham, Tooting and Merton, will have been opened. To accommodate the southbound trains of the Hampstead Tube at Charing Cross a new platform will be constructed. The Kennington extension will be the fourth railway built under the Thames between the Tower and Westminster.

Liverpool.—YEAR'S WORKING.—The report on the working of the city tramway undertaking (general manager, Mr. P. Priestley) for the year ended March 31st last records a total revenue of £1,394,386. Working expenses totalled £1,063,324, leaving a gross surplus of £331,062. Interest and sinking fund charges absorbed £90,635 and there was a net profit of £240,427. From this sum, however, £203,193 was deducted, being the amount spent out of current revenue on renewal of permanent way, cars, &c., leaving a balance to be transferred to reserve of £37,234. The result for the 15 months ended March 31st, 1923, was a net profit of £414,918. The number of passengers carried increased from 174,730,764 to 207,670,401, and the car-miles run from 14,790,551 to 15,731,411. In July of last year, the Muirhead Avenue extension and the Longmoor Lane extension were inaugurated. During the year 42 cars have been reconstructed and put into service. New tramcar works are being constructed in Edge Lane with an area of 7¾ acres.

Telegraph and Telephone Notes.

Australia.—LONG-DISTANCE RADIO SERVICE.—The Commonwealth Government, which holds a controlling interest in Amalgamated Wireless (Australasia), Limited, is proceeding with plans for the establishment of a comprehensive service capable of affording direct communication between Australia and Europe, as well as America. Amalgamated Wireless, Limited, will shortly erect in Australia, a high-powered station in the vicinity of Sydney. In each of the other capital cities of the Commonwealth there will also be a feeder station for direct communication with the high-powered station and the subsidiary feeders. It is proposed that the charges on all messages shall be reduced by 33⅓ per cent., and there will be special concessions for week-end radiograms.—*The Times.*

Imperial Radio Communication.—COMMITTEE.—Mr. V. Hartshorn, the Postmaster-General, stated on July 1st that the committee on the organisation of the Imperial Wireless Services had been constituted as follows: Sir Robert Donald (chairman), Sir Arthur Balfour, Sir G. L. Barstow, Mr. J. W. Bowen, Sir Henry Lambert, Sir Alfred Mond, Sir G. E. P. Murray, Sir Edwin Stockton, and Sir Campbell Stuart.

Lithuania.—TELEPHONE SERVICE.—The telephones in Lithuania are owned by the Government and are under the control of the Department of Ways and Communications. The telephone was practically unknown in Lithuania for general use until installed in 1915 by the Germans at the time of their occupation of the country. The apparatus was, however, recently replaced with apparatus manufactured in Esthonia by the Tartu Telefoni Wabrix A. S. The central exchange office at Kovno accommodates 1,012 subscribers. Nevertheless, the number of telephones now in use is twice what it was a year ago. There are 44 operators at the central exchange and besides giving local service a long-distance service is maintained to all parts of Lithuania, to Latvia, and to points from Kovno to Konigsberg, East Prussia, and to Berlin. A few banking establishments have installed private branch exchanges, and the central office has provision for 200 such branches.—*Commerce Reports.*

The Telephone Service.—CAPITAL NEEDED.—A memorandum issued for presentation to Parliament in connection with the Telegraph (Money) Bill, 1924, explains that capital for this purpose is normally provided by advances made by the National Debt Commissioners and repaid to them by means of annuities charged on the Post Office vote, the advances authorised to date amounting to £69,421,083. The last Act, passed in 1922, authorised the issue of capital to the extent of £15,000,000, which will, it is estimated, be exhausted by July. The Engineering Works Estimates sanctioned by the Treasury for the current year will involve an expenditure of about £8,200,000. The present Bill authorises the issue of £17,000,000, which, it is expected, will meet the capital requirements of the telephone service for about two years.—*The Times.*

Radio Notes.

High-power Broadcasting.—THE CHELMSFORD STATION.—The B.B.C. high-powered station at Chelmsford, Essex, was opened for experimental work on July 9th. The hours of transmission provisionally fixed are 11.30 a.m. to 12.30 p.m., 4 to 5 p.m., and 7.30 to 8.30 p.m. The morning and afternoon programmes will be mostly talks, but it is hoped that some music will be played during the evening programmes. The wave length is 1,600 metres. The power will be announced later; it will not be less than 15 kW. The call sign is 5XX. Listeners are invited to write to the British Broadcasting Co., giving details of their results.

LEEDS RELAY STATION.—The B.B. Co. opened the relay broadcasting station at Leeds on July 8th, and as a test the London programme was re-transmitted from it on July 4th. The call sign is 2 LS, and the wave length 346 metres.

Japan.—BROADCASTING.—The first Government broadcasting station in Japan has just been completed in the central radio station in Shiba Park. In order to promote a general knowledge of radio and its uses steps have been taken to include in school text-books simple lessons demonstrating the value of this means of communication. The Department of Communications is still engaged in drawing up the necessary regulations for the control of broadcasting, and has, according to report, decided to licence one station with a radius of 100 miles for each of the nine cities of Tokio, Osaka, Sapporo, Sendai, Aomori, Nagoya, Hiroshima, Fukuoka, and Niigata. In other cities the radius of the licensed station is limited to 20 miles. Applications for permission to operate broadcasting stations are far in excess of the number of licences to be granted, and a rigid scrutiny of the qualifications of each applicant will be necessary before the licence can be granted and the broadcasting service inaugurated.—*Reuter* (Tokio).

Radio Transmission from Trains.—RADIO SOCIETY'S TESTS.—On July 4th, from the commencement practically to the end of the journey messages and broadcast programmes were received on, and messages transmitted from the 7.38 Aberdeen express from King's Cross in the course of its run as far as Newcastle-on-Tyne. The experiment was conducted by the Radio Society of Great Britain, in collaboration with the London and North-Eastern Railway. The chief object of the test was to try and find out reasons for "fading" effects. The aerial ran in two lengths inside the coach and close to the roof, earth connection being made to the steel chassis of the wagon and then through the wheels to the rails.

South Africa.—ANOTHER STATION.—Radio broadcasting is to be started at Cape Town in September next. The inauguration of a broadcasting station at Johannesburg on July 1st has been followed by a great demand for receiving licences. The wavelength is between 350 and 450 metres; a 500-watt transmitting set is used. The Associated Societies' licence gives an area for the collection of fees from listeners extending 100 miles in all directions from Johannesburg, and it is expected that the station will be supported by the fees paid in by persons owning receiving sets.

United States.—NOMENCLATURE.—The Convention of the Associated Manufacturers of Electrical Supplies has officially banned the word "broadcasting" and substituted "radiocasting" as being more applicable.—*Reuter.*

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Ashton-under-Lyne.—July 16th. Electric light installation at United Methodist church and school, Trafalgar Square. Specifications from Mr. T. Smith, 66, Ryecroft Street, Ashton-under-Lyne.

Belgium.—July 16th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. 40 lots of telephonic apparatus and accessories. Particulars (Cahier des Charges No. 3-38) for 8 fr.

Canada.—August 5th. City of Toronto, Department of Works. Supply and installation of three centrifugal sewage pumps, direct-connected to electric motors.*

China.—HANKOW.—September 30th. Hankow Water Works and Electric Light Co. Nine 1,000-kVA transformers for 2,300/6,000 volts; six 210-kVA transformers for 2,300/460 volts.

Edinburgh.—July 14th. Education Authority. Lighting installation at Davie Street school. Plans from Education Offices.

Ennis.—July 15th. In connection with the supply of electricity to St. Flannan's College. One 12-kW shunt-wound d.c. generator, direct coupled to a horizontal single-cylinder engine for working on crude oil; storage battery of approximately 350 ampere hours; wiring the college. Plans, specifications, and forms of tender from Canon O. Kennedy, president.

Hull.—July 14th. Tramways Sub-Committee. 1,000 or 1,500 tons tramway rails, with fishplates and sole plates. Mr. F. W. Bricknell, city engineer, Guildhall, Hull.

Horsham.—July 25th. Electricity Department. One 200-300-b.h.p. vertical-type heavy-oil engine for direct-coupling to a d.c. generator. (See this issue.)

India.—DELHI.—August 24th. Controller of Stores. Manufacture, delivery, and erection of passenger and goods lifts in Government buildings. (June 27th.)

Lanark.—The Middle Ward District Committee will shortly issue schedules in connection with electric lighting installation for 150 new houses. Particulars from Mr. P. C. Smith, District Offices, Hamilton.

Leyton.—July 18th. Urban District Council. Electrical wiring ("Henley" system) at six schools. (June 27th.)

London.—H.M. OFFICE OF WORKS.—July 15th. Electric wiring in steel conduit at Somerset House. (June 27th.)
July 22nd. Incandescent lamps. (See this issue.)
HANWELL.—July 26th. Electric lighting installation at the Central London District School. (June 27th.)
ST PANCRAS.—July 15th. Electricity Committee. Two water-tube boilers, 40,000 lb. each, complete with pulverised fuel plant. (June 27th.)
METROPOLITAN ASYLUMS BOARD.—July 16th. Installation of electric lighting and power mains, &c., at the offices of the Board, installation of internal telephone system at the Accountant's Department, and installation of an internal telephone system in the Engineer-in-Chief's Department. (June 27th.)
LAMBETH, S.E.—India Store Department. July 28th. Porcelain insulator cups. (June 27th.)
LONDON COUNTY COUNCIL.—August 11th. One electrically-driven tower wagon complete. (June 27th.)
250-kW motor-generator set for the National Physical Laboratory, Teddington. (See this issue.)
HACKNEY.—July 23rd. Board of Guardians. Installation of electric lighting at the branch institution and schools, Brentwood. Mr. F. R. Coles, clerk to the Guardians, 2, Sidney Road, Homerton, E.

Lowestoft.—July 14th. Mutford and Lothingland Board of Guardians. Installation of electric lighting at the Workhouse and Infirmary. (June 27th.)

Newcastle-upon-Tyne.—July 12th. Tyne Improvement Commission. One 20-h.p. and three 3-h.p. d.c. electric motors for the Albert Edward Dock, North Shields. Mr. A. Blacklock, secretary, Tyne Improvement Commission Offices, Bewick Street, Newcastle-upon-Tyne.

Newton-in-Makerfield.—July 28th. Electricity Committee. E.h.p. and l.p. switchgear, e.h.p. and l.p. cables, rotary converter equipments, and static transformers. (See this issue.)

New Zealand.—DUNEDIN.—August 15th. City Corporation. One synchronous condenser.
WELLINGTON.—August 26th. Department of Public Works. One 30-ton electrically-operated overhead travelling crane for Lyttelton.*

Rothwell.—Education Committee. Electric light installation at Infant Department of Rothwell-Stourton Council School. Specifications from Mr. Percy Beaumont, divisional clerk, West Riding Education Offices, 8, St. John's North, Wakefield.

Rumania.—TIMISOARA, TRANSYLVANIA.—July 31st. Town Electricity Works. Central switchboard.*

Saffron Walden.—July 21st. Town Council. Electricity supply plant and overhead mains. (June 27th.)

South Africa.—CAPE TOWN.—July 22nd. Municipal Council. H.p. ironclad switchgear.*
July 31st. Cables.*
Various workshop appliances, including portable electric drills, arc welding plant, &c.*
JOHANNESBURG.—July 31st. Municipal Council. Single-phase transformers and spares. Switchgear panels.*

Uruguay.—MONTEVIDEO.—August 20th. State Electricity Works. 45,000 metres of lead-covered cable.*
August 21st. Special cables.*
August 26th. Rubber-insulated cords. L.p. and telephone cables.*

Walthamstow.—July 23rd. Education Committee. Installation of electric lighting in seven schools. (See this issue.)

Warrington.—August 5th. Electricity and Tramways Committee. Extension e.h.p. main switchboard and substation truck switchgear. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Barnstaple.—Town Council. Accepted:—
Cables to Sticklepath (£972).—W. T. Henley's Telegraph Works Co., Ltd.

Belgium.—Belgium, France, Italy, Denmark, Czecho-Slovakia, Holland, Germany, and Great Britain (Callender's Cable and Construction Co., Ltd., the British Insulated and Helsby Cables and Metropolitan-Vickers Electrical Co., Ltd.) submitted tenders last week for two cable contracts for the municipal authorities at Schaerbeek, near Brussels. The lowest offer for 3 kilometres of 3 x 25 mm. high-pressure armoured cable was that of Callender's Co., London, who quoted 16,450 fr. per kilometre. The other quotations ranged up to 25,850 fr. per kilometre. For the second lot of 10 kilometres of low-pressure 3 x 5 x 10 mm. armoured cable, the Nederlandsche Kabelfabriek, of Delft, Holland, was successful in submitting the lowest tender, *viz.*, 13,540 fr. per kilometre.
German firms competed against home concerns for the contract for the supply and laying of the electricity mains required for the extension of the system in Molenbeek-Saint Jean, near Brussels. La Société des Ateliers de Constructions Electriques de Charleroi, succeeded, however, in submitting the lowest offer (1,230,119 fr.).
No fewer than 16 concerns—nine Belgian, four Dutch, and one each French, German, and Czecho-Slovakian—submitted tenders last week to the municipal authorities of Antwerp for the supply and erection of 15 3-ton electrically-operated dock cranes. The prices ranged from 2,439,825 fr. to 4,827,000 fr., the lowest offer being that of the Société Le Titan Anversoise, of Hoboken.

Colombia.—CARTAGENA.—Cartagena Waterworks, Ltd.
Insulators for overhead transmission lines in connection with the electric light and power scheme for the city.—Bullers, Ltd.

Enniscorthy.—Urban Council. In connection with the Council's electric lighting scheme, the following tenders have been accepted:—
Engines, generators, air compressor, cooling tower, and service fuel tank (£2,630).—Mirrlees, Bickerton & Day, Ltd.
Switchboard, cable and cable rack, clock, &c. (£988).—General Electric Co., Ltd.
Battery, sundry spares, and instruments (£940).—Chloride Electrical Storage Co., Ltd.
Motor booster and balancer (£264).—Metropolitan-Vickers Electrical Co., Ltd.
Tank and fittings (£254).—The Boving Engineering Works, Ltd.
Overhead mains and street lamps (£3,561).—The Irish Engineers, Ltd.

London.—HOLBORN.—Borough Council.
Nine months' supply of m.f. high-wattage lamps for street lighting.—General Electric Co., Ltd.

HACKNEY.—Electricity Committee. Recommended:—
Erection of electricity showrooms and offices in Lower Clapton Road (£36,072).—J. Jarvis & Sons, Ltd.

Manchester.—Education Committee. Accepted:—
Electric lighting installation, St. Mary's Road School.—Seddon & Sons.

Electricity Committee. Accepted:—
Supplies of cable during 12 months to June 30th, 1925.—British Insulated and Helsby Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; C. Macintosh & Co., Ltd.; Pirelli-General Cable Works, Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Western Electric Co., Ltd.; Johnson & Phillips, Ltd.; Hackbridge Cable Co., Ltd.
Air heater, fan, and motor, Stuart Street station.—Underfeed Stoker Co., Ltd.
One 336-kW mercury-vapour rectifier equipment.—Hewittic Electric Co., Ltd. Sub-contractor for transformer: Hackbridge Electric Construction Co., Ltd.
Switchgear.—Metropolitan-Vickers Electrical Co., Ltd.; Ferguson, Pailin, Ltd.; Park Royal Engineering Works, Ltd.

Reigate.—Town Council. Accepted:—
Silencer for the third engine at the electricity works (£390).—Mirrlees, Bickerton & Day, Ltd.

Spain.—The Siemens-Schuckert concern has obtained the contract for the supply of motor rail coaches and goods wagons for the electric railway between Zumárraga and Zumaya, near San Sebastian.—*Reuter's Trade Service* (Madrid).

Whitehaven.
Electrical installation at H.M. Customs House.—T. S. Bell & Co.

Forthcoming Events.

Institution of Electrical Engineers.—KELVIN CENTENARY CELEBRATIONS.—Friday, July 11th. At the Connaught Rooms, Great Queen Street, W.C.2. At 6.45 for 7.15 p.m. Kelvin Centenary Banquet.
Saturday, July 12th, to Tuesday, July 15th. Visits to Cambridge, Birmingham, Windsor, &c. (See "Notes.")
Physical Society of London.—Saturday, July 19th. At Cambridge. Special meeting. Visit to the works of the Cambridge Instrument Co. Visit and meeting at the Cavendish Laboratory.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.
We should be glad to learn the names of makers or suppliers of:—
The "Fairy Floss" candy-making machine.
The address in London of Mr. Nettlefold, of the Hume Pipe Co. of Australia, is asked for.
Information is sought regarding the "Jydsk" induction motor.

Notes.

The British Association.—The preliminary programme of the Toronto meeting of the Association, which is to be held from August 6th to 13th, is now available. The president, Maj.-Gen. Sir David Bruce, will deliver his address on the first day of the meeting, taking as his subject "The Prevention of Disease." In accordance with the practice followed at the last two or three meetings, the presidents of sections will deliver their addresses at different times. Prof. G. W. O. Howe, president of Section G—Engineering, will speak on "One Hundred Years of Electrical Engineering." Sir William Bragg, as the president of Section A—Mathematics and Physics, will deal with "The Analysis of Crystal Structure by X-rays." The subject of the address to be given by Sir William Ashley to Section F—Economics, is "A Retrospect of Free Trade Doctrine."

As was to be expected, water power is one of the principal subjects with which Section G will deal. Among the papers which are to be read are the following:—"Proposed Improvements of the St. Lawrence and Great Lakes Systems for Power and Navigation," by Mr. D. D. McLachlan; "The Hydro-Electric Power Commission of Ontario," by Mr. F. A. Gaby; "The Development of the St. Lawrence River for Power and Navigation," by Mr. R. S. Lea; "Railway transportation in Canada," by Sir Henry Thornton; "The Water Powers of Canada," by Mr. J. B. Challies; "Cobalt Magnet Steels," by Mr. E. A. Watson; and "The Future of Power from Fuel," by Mr. E. K. Scott.

In the Chemistry Section (B) there will be discussions upon the electro-chemical industries of Canada, and liquid and powdered fuels. The papers to be read before Section A include:—"Wireless Time Signals," by Messrs. R. M. Stewart and J. P. Henderson; "The Automatic Measurement of Atmospheric Pollution," by Dr. J. S. Owens; "The Scattering of X and Gamma Rays and Production of X-rays by Photo-electrons," by Prof. J. A. Gray; and "The Quantum Theory of the Scattering of X-rays," by Prof. A. H. Compton.

Among the papers to be presented to Section I—Physiology, is one on "The Distribution of Electrolytes in the Blood," by Dr. D. D. van Slyke.

Very elaborate arrangements have been made for the reception of the visitors; grants for this purpose have been made by both the Dominion and Provincial Governments. The International Mathematical Congress is taking place in Toronto about the same time. An extended tour of the Dominion will be made after the meeting, and visits to places of interest in the United States have also been arranged.

Canadian Telephone Patent Litigation Settled.—It was recently stated in *Telephony* that an agreement had been reached between the Northern Electric Co., of Montreal, Canada, and Siemens Bros. & Co., of London, settling out of court extensive and important patent litigation pending in the Canadian courts, in which litigation the Northern Electric Co. had claimed infringement by the Siemens company of important automatic telephone patents owned by the Northern company in Canada. The official announcement of the contesting companies regarding the terms of settlement is as follows:—

"Under the terms of settlement, the Siemens Company acknowledges the validity of the patents of the Northern Electric Co., Ltd., and the International Western Electric Co., Inc., in Canada, relating to automatic telephone exchange equipment and accepts a licence thereunder. The Siemens company further licenses the Northern Electric Co., Ltd., and International Western Electric Co., Inc., under its patents in Canada relating to automatic telephone exchange equipment."

Fire.—GLASGOW.—Considerable damage was caused by fire on July 3rd in the premises occupied by Messrs. Hunter and Jack, electrical and heating engineers, Cranstonhill, Glasgow. The roof of the building was completely destroyed and damage was done to the contents, which consisted principally of electrical goods.

The Channel Tunnel.—The meeting of the Committee of Imperial Defence called by the Prime Minister to consider anew the question of the construction of a tunnel beneath the English Channel was held on July 1st. It was reported at the conclusion of the meeting that the views of the Service members of the Committee had undergone no change, and they still considered that the tunnel should not be constructed. They took the view that an effective system of ferries between various points on the English and French coasts would provide as satisfactory means of communication as a tunnel.

Mr. Ramsay MacDonald made a statement in the House of Commons on July 7th in which the Committee's reasons for rejecting the scheme were put forward. He said that while many went to the meeting predisposed in favour of the construction of the tunnel, the arguments placed before the meeting by the military and naval advisers forced them to adopt the opposite view. While opinion differed considerably as to the extent of danger from a military point of view, there appeared no room for doubt that the existence of a tunnel would be bound to add to the anxieties of those responsible for national defence, to our commitments, and to our expenditure. The Committee was also advised that if ever the tunnel were built Government ownership would tend to facilitate the taking of measures for its security or destruction.

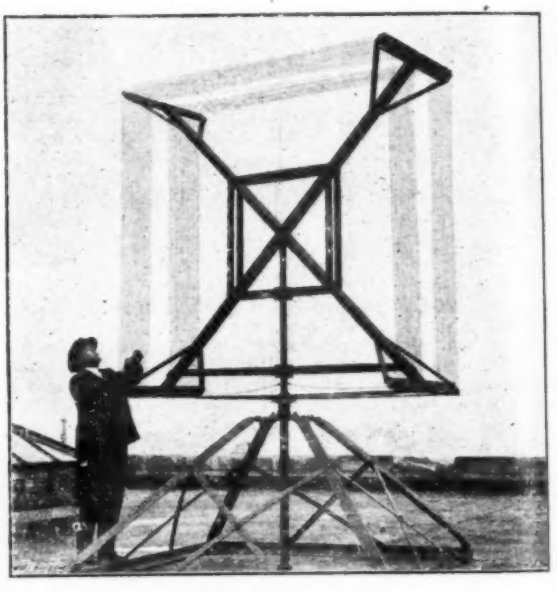
In reply to a question by Mr. McNeill, the Prime Minister said that he did not think a Select Committee of the House could carry the same weight as the opinion of the Committee of Imperial Defence.

On July 3rd a meeting of the French Channel Tunnel Committee was held to consider the position, under the presidency of M. Le Trocquer. *The Times* says that the Committee decided to continue its labour in friendly collaboration with the British Committee and the other committees of Allied nations.

Social Events.—The Yorkshire Electric Power Company held its fifth annual sports and children's outing on June 28th, at the Rectory Grounds, Thornhill. There was a long programme of events, including the distribution of toys to the children. During the afternoon music was provided by the band of the 4th Battalion, King's Own Yorkshire Light Infantry.

The second annual outing of the staff of Messrs. L. G. Hawkins & Co., Ltd., took place on June 28th. The party, including directors, went to Bourne End, where the day was devoted to tennis, boating, &c.

A Large Frame Aerial.—A large frame aerial has been erected on the roof of the tower of the Bush Building, Aldwych, W.C., by the United States Shipping Board, to conduct business communication between London and the United States. The aerial is 8 ft. by 8 ft., and is wound round with 48 turns of wire, measuring in all 1,536 ft. The apparatus consists of nine valves (four high- and two low-frequency, one detector, and two 10-watt power amplifiers for loud speakers), and messages can be received from places 8,000 miles distant. It was designed by Mr. R. H. Redmond, the European radio supervisor of the United States Shipping Board. The accompanying illustration shows Mr. Redmond with his aerial, which, being mounted on ball-bearings, can be turned in any direction from the interior of Bush House by a wheel.



A Large Frame Aerial.

International Mathematical Congress.—An International Mathematical Congress will be held at Toronto from August 11th to 16th, under the auspices of the Royal Canadian Institute and the University of Toronto. Special prominence will be given at this meeting to the engineering and other practical applications of mathematics, and contributions have been invited from mathematical physicists and engineers engaged in mathematical investigations of engineering problems. Seventy scientific institutions on the American continent, and 90 in Europe and elsewhere have arranged to send one or more delegates to the Congress. The Congress will meet in the following sections:—

Section I: Algebra, Theory of Numbers, Analysis; Section II: Geometry; Section III: (*a*) Mechanics, Mathematical Physics, (*b*) Astronomy, Geophysics; Section IV: (*a*) Electrical, Mechanical, Civil and Mining Engineering, (*b*) Aeronautics, Naval Architecture, Ballistics, Radiotelegraphy; Section V: Statistics, Actuarial Science, Economics; and Section VI: History, Philosophy, Didactics.

This arrangement of sections is designed to afford in the sphere of applied mathematics, full opportunity for consideration, not only of those questions in which interest is purely scientific, but also of practical problems of engineering, the solution of which contributes directly to the cause of progress. Additional information may be obtained from Professor J. K. Synge, Royal Canadian Institute, Toronto, Canada.

A New American Electric Locomotive.—The construction of the first electric locomotive for the Detroit, Toledo and Ironton Railroad will be started on July 15th. The railway is owned by the Ford Motor Car Co., and the engine was designed by that company and will be built in the Detroit, Toledo and Ironton shops at River Rouge from parts that have already been constructed. The engine is designed to utilise high-pressure power from an overhead circuit, and to carry its own transformer, thereby obtaining the economies of both direct and alternating current without the disadvantages of either. Recently a number of the parts were assembled on flat cars and tested to prove that the Ford theory for the new locomotive was practical before the actual construction was undertaken. The results satisfied the Ford engineers and the representatives of some of the biggest electrical companies in the United States who witnessed the demonstration. The new locomotive will be 117 ft. long, weigh 340 tons, and have a tractive effort of 200,000 pounds. It is designed especially to handle large shipments of coal.—*Reuter's Trade Service* (New York).

French Electric Vehicle Trials.—Another reliability trial of electric vehicles is to be held in France from September 15th to 26th next by the Union des Syndicats d'Electricité. The competing vehicles will be divided into eight categories, *viz.*: (1) those with a useful carrying capacity up to 12 cwt.; (2) from over 12 to 24 cwt.; (3) over 24 to 35 cwt.; (4) over 35 to 50 cwt.; (5) over 50 to 70 cwt.; (6) over 70 to 110 cwt.; (7) those over 110 cwt.; and (8) electric tractors. Each class will be sub-divided into categories as regards lead or iron-nickel batteries and as to whether the routes are covered with or without re-charging. The points to be recorded are: (1) the electrical energy consumed on each of the daily runs per useful and total ton-mile; (2) the energy taken at the charging station during the trials and the consumption over the same period, and (3) the speed and degree of regularity of running attained. One of the regulations requires that the batteries must be of a type that is available to purchasers in the open market and must conform to the standards drawn up by the Syndicat Professionnel des Industries Electriques. The trials will extend over 10 days, with daily runs ranging from 31¼ to 56¼ miles according to the category. Full particulars of the event can be obtained from the Union des Syndicats de l'Electricité, 25, Boulevard Malesherbes, Paris. Entries will be received up to July 15th at fees ranging from 500 to 1,500 fr. per vehicle according to the class.

Photography.—Mr. T. Thorne Baker recently read an excellent paper before the Royal Society of Arts on "Photography in Science, Industry and Medicine." His demonstration of the extent to which photography is used as an aid to science will probably come as a revelation to most people. The spectroscopic camera, or spectrograph, is invaluable as a means of rapid chemical analysis, especially as it indicates exceedingly minute quantities. One of the most recent inventions is a photo-micrographic apparatus by which magnifications of 25,000 diameters can be obtained. The use of X-rays in medicine and surgery, and also in such cases as detecting flaws in metals and other materials is growing day by day, and with the rapid advances in the technique of photography, they can be so employed with ever-increasing advantages. Mr. Thorne Baker, in his comprehensive review, gave an illuminating account of the many directions in which photography is now being applied to scientific purposes: perhaps one of his most striking instances was that of a cardiograph record taken in a consulting room half-a-mile from where the patient lay.

"Wireless" Navigation.—The use of radio-telegraphy and telephony in foggy and bad weather must be an enormous relief to the navigator. Dr. J. Robinson, in his paper on "Wireless Navigation for Ships and Aircraft," read before the Royal Society of Arts, described various systems (including his own) whereby signals are transmitted from direction-finding stations. It would appear that far greater advantage is taken of these aids to navigation in America than in this country. In the approaches to New York Harbour alone there are far more stations than in the whole of England.

Terrestrial Magnetism.—According to the Astronomer-Royal's report, the magnetic elements at Greenwich are: declination 13 deg. 35.1′ W.; horizontal force, 0.18452 C.G.S. units; vertical force, 0.43187 C.G.S. units; dip, 66 deg. 51.9′.

Water Power in the Canadian Paper Industry.—According to a recent report published by the Dominion Water Power Branch of the Canadian Department of the Interior, it requires 100 h.p. to produce a ton of paper per day; the importance of cheap power to the industry is therefore very apparent. The pulp and paper industries of Canada use in the aggregate 726,375 water h.p., and over 60 per cent. of this total (438,700 h.p.) is converted into electricity before use. This has enabled the sites of paper mills to be selected with more regard to transport and labour facilities and wood supplies, instead of their being placed on out-of-the-way water power sources. According to the last completed census, only 60,764 h.p. of steam engines is now employed in the industry.

At the present time there is considerable activity in power development for new pulp mill construction and in providing additional power for existing mills. The largest development in progress is that at the Grand Discharge of the Saguenay River, which will have an ultimate capacity of 420,000 h.p. Over 300,000 h.p. has already been contracted for by the Price interests for pulp and paper production. An American company is building a mill at Sheet Harbour, N.S., for which it will require 6,000 h.p. of electrical energy; the Nova Scotia Power Commission is installing plant for the supply of this power. In Quebec the construction of mills together with water-power development is proceeding at St. Andrews East, Godbout, Richmond, and other places. There is another large project of a similar nature in hand near Winnipeg.

Power and Unemployment.—*The Times*, in its Political Notes on Wednesday, stated that the Parliamentary Labour Party was faced with two disappointments in connection with the Government employment plans—one, the abandonment of the Channel tunnel scheme, and the other the improbability of anything emerging from the Seven Barrage Scheme. "In the circumstances, the Labour Party will probably impress upon the Government the need of proceeding with its programme of electrification post haste."

Appointments Vacant.—Resident electrical engineer for the Borough of Harwich electricity supply scheme. Leading plumber-jointer for the Great Yarmouth Corporation Electricity Department. Switchboard attendant for the Dewsbury Corporation Electricity and Tramways Department. (See our advertisement pages to-day.)

Cahokia Power Station.—CORRECTION.—Owing to an operative's error, whilst the last issue of the ELECTRICAL REVIEW was in the press the block of fig. 2 on p. 25 was reversed, and the illustration was printed upside down.

The World Power Conference.—SOCIAL EVENTS.—On Thursday, July 3rd, the American Committee gave a banquet to the delegates at the Hotel Cecil, at which over 500 persons were present, including a large proportion of ladies. After the loyal toasts, the chairman, Mr. O. C. Merrill, expressed the appreciation of the American delegates for the courtesy that had been extended to them, and their admiration for the manner in which the Conference had been organised and conducted, with a special tribute to Mr. D. N. Dunlop. Dr. A. T. Hadley then delivered an eloquent "Address of Welcome," declaring that they owed the English nation a debt of gratitude, and were happy to work with them on the social as well as the intellectual side, which enabled them not only to learn what other men were doing, but also to know the men themselves.

Mr. P. J. Pybus responded, emphasising the extreme importance of the economical use of the world's resources of energy. Legislation followed on public opinion, and it was for the Conference to mould public opinion so that waste of fuel would be prevented, not only in Great Britain, but in all countries. When in the United States recently, he was immensely impressed by the activity with which the more efficient use of power was being promoted.

Dr. M. Kamo (Japan), Mr. E. Uytborck (Belgium), and Mr. John Murphy (Canada) also responded, and afterwards Mr. H. J. Pierce delivered an address on "The Romance of Water Power." Finally, Dr. A. E. Kennelly spoke, pointing out that property implied trusteeship, and hence it was their duty to conserve the resources which Nature had entrusted to their hands, and to make the best possible use of them. Whatever future conferences might bring, none could be more cordial or delightful than the present one.

On the following day a luncheon was given by the Canadian National Committee.

VISITS ORGANISED BY THE I.E.E.—To-day is kept free for those wishing to visit the British Empire Exhibition, but to-morrow, July 12th, a visit will be made by special train from King's Cross to Cambridge, where the Cavendish Laboratory will be inspected, and the party will lunch in the dining hall of Trinity College as the guests of the College. Places of interest will be visited, and the Vice-Chancellor will receive the visitors at 5 p.m. and entertain them to tea before they return to London, where they are due at 7.30 p.m.

On Sunday, July 13th, seats will be reserved at the morning services at Westminster Abbey and St. Paul's Cathedral, and in the afternoon the Zoological Society's gardens and aquarium will be open to the visitors.

On Monday, July 14th, the visitors will leave Euston at 9 a.m. by special train for Birmingham, and proceed to the University Engineering Laboratories or the Nechells power station.

The Lord Mayor will entertain them at luncheon at 1.10 p.m., and at 2.30 the party will leave by motor coach for Stratford-on-Avon, where tea will be served at the Shakespeare Hotel and the Red Horse Hotel. Next a visit will be made to Leamington Spa, and, leaving there at 7.55 p.m. by special train, the visitors will dine *en route* as the guests of the L.M.S. Railway Co.

On Tuesday, July 15th, at 10 a.m., motor coaches will convey the visitors from the Victoria Embankment to the repair shops of the London General Omnibus Co., Ltd., at Chiswick. After lunch (at the invitation of Lord Ashfield, chairman of the Underground Electric Railways of London, Ltd.) the party will drive to Windsor and visit the State Apartments, take tea at the White Hart Hotel, and return to London. In the evening, at 8.30, there will be a conversazione at the Institution of Civil Engineers, by invitation of the Councils of the Institutions of Civil, Mechanical, and Electrical Engineers.

The official tours of the World Power Conference will commence on July 14th.

Institution Notes.

Institution of Electrical Engineers.—The Council has awarded premiums, value £10 each, to the following students for papers read during the session 1923-24:—Mr. N. B. Hill (Cape Town); Mr. A. I. MacNaughton, B.Sc. (Eng.) (Airdrie); Mr. V. Mitchell (Settle, Yorkshire); Messrs. O. Morduch (Manchester) and A. W. Metcalf (Manchester); Mr. B. Nuttall (Manchester); and Mr. A. C. Warren (London).

NORTH-WESTERN CENTRE.—On July 9th a summer visit was paid to the Preston area of the Centre, at the invitation of the English Electric Co., Ltd., and the County Borough of Preston (borough electrical engineer, Mr. J. F. Simpson, M.I.E.E., M.I.M.E.; consulting engineer, Mr. J. A. Robertson, M.I.E.E., M.I.M.E.). Charabancs conveyed the members to the English Electric Co.'s works; during the morning a tour of inspection of the works was made in parties, and luncheon as guests of the company was partaken of at the works, and in the afternoon charabancs conveyed the party to the new Ribble power station of the County Borough of Preston. The party returned to the English Electric Co.'s works to partake of afternoon tea, returning by charabancs to the station in time for the 4.58 train to Manchester.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Mr. H. G. MACKLIN, formerly assistant engineer at the Ladysmith power station, Whitehaven, has been appointed chief resident engineer at the Ribble power station, near Preston. There were over 90 applicants for the post.

In recognition of his work in connection with large electrical plant, the Technical High School of Carlsruhe has just awarded the degree of Dr.Ing. to Herr BOVERI, of the firm of Brown, Boveri & Co.

Mr. D. M. FRASER, president and general manager of the Dominion Engineering Agency, Ltd., of Toronto, is returning to Canada, *via* New York, on July 26th by the *Aquitania*.

Mr. ERNEST J. POWER, who has been for a number of years with Messrs. Christy Bros., has been appointed secretary and engineer of the Burnham and District Electric Supply Co., Ltd., Somerset.

The marriage took place at Retford, on June 25th, of Mr. A. C. WARHAM, a member of the staff of the Halifax Corporation electricity works, to Miss CONSTANCE M. ATTON.

Mr. A. MCDOUGALL, late of the Madras Electric Supply Corporation, Ltd., and previously with the Delhi Electric Tramways and Lighting Co., Ltd., has joined the staff of the Anglo-Persian Oil Co., Ltd. His postal address will be c/o A. P. O. C., Ltd., Mohammerah, Persian Gulf.

After a long and heated discussion, Manchester City Council, on July 2nd, decided to increase the salary of Mr. Mattinson, general manager of the tramways, from £1,400 to £1,800 a year. Members of the Establishment Committee and others referred to the magnitude of the undertaking and to the necessity of keeping satisfied an efficient servant when they had got him. One of the objections taken to the increase was that it would create unrest among other officials.

The daily Press reports that Mr. G. G. BELL, borough electrical engineer, Hammersmith, who has been given three months' leave of absence on account of illness, has made a request to be allowed to retire under the Superannuation Act. Mr. Bell has been 30 years at Hammersmith. The application has been referred to a committee of the whole Council for consideration.

The salary of the Liverpool city electrical engineer, Mr. H. DICKINSON, has been converted from £1,800 and war bonus of £125 to £2,250 as an inclusive salary. This recommendation was confirmed by the Liverpool City Council on July 2nd. Other revisions approved were:—Mr. P. PRIESTLY, general manager tramways undertaking, £1,400, and no war bonus, to £1,600; and Mr. P. J. ROBINSON, deputy city electrical engineer, £900, and war bonus of £125, to £1,250.

The new address of Messrs. C. R. ST. JOHN & PARTNERS, consulting engineers, is Windsor House, Victoria Street, S.W.1. Telephone: Victoria 5736.

Mr. TREVOR JONES, for several years manager of the Oswestry electric light works, who is leaving to take up another appointment, has been presented by the employés with a silver cigarette case.

Mr. C. W. PHILLIPS, formerly of the Solidite Manufacturing Co., Ltd., has been appointed sales manager to Ebonestos Insulators, Ltd.

The Council of the Royal Society of Arts has awarded the Society's Silver Medal to the authors of the following papers read during the past session:—Sir RICHARD A. S. PAGET, Bart., "The History, Development, and Commercial Uses of Fused Silica"; Mr. F. HOPE-JONES, M.I.E.E., "The Free Pendulum"; Mr. T. THORNE BAKER, "Photography in Industry, Science, and Medicine"; and Brig.-Gen. H. A. YOUNG, "The Indian Ordnance Factories and Indian Industries."

Mr. ALEXANDER MILNE has been transferred from the Glasgow office of Messrs. Malcolm & Allan, Ltd., having been appointed manager of the Edinburgh branch (17, St. Andrew Street).

Mr. G. H. BAILLIE announces that, following on the retirement of Mr. A. Dobrée, he is continuing the business of the firm of Baillie & Dobrée, formerly of 101, Victoria Street, S.W., under the style of G. H. Baillie, at Windsor House, Victoria Street, S.W.1.

The title of Associate Professor has been conferred upon Mr. F. J. TEAGO, D.Sc., M.I.E.E., lecturer on electrical machinery in the Department of Electrical Engineering at Liverpool University.

Mr. F. S. SPIERS, secretary and editor to the Faraday Society and secretary to the Institute of Physics, has moved his office to 90, Great Russell Street, W.C.1 (telephone: "Museum 5718"). The publishing office of the *Journal of Scientific Instruments* is now also at that address.

Captain CHARLES CROMPTON, M.I.E.E., has taken up the position of superintending engineer for the West of Scotland P.O. Engineering District, rendered vacant by the recent retirement of Mr. R. Waring. Captain Crompton goes to Glasgow from Cardiff, where he was in charge of the South Wales district. He served previously as superintending engineer in the Scotland East district with headquarters at Edinburgh.

On Friday last the honorary degree of Doctor of Science was conferred upon Dr. ELIHU THOMSON, at Manchester University. Prof. Miles Walker said that Dr. Thomson left Manchester at a very early age for Philadelphia, where he became one of the world's greatest engineers.

Reading Town Council has appointed Mr. C. H. STAFFORD as chief assistant engineer in the tramways department at a salary of £450 per annum.

Mr. VOWLES, maintenance engineer at the Worcester Corporation electricity works, has been appointed power station superintendent at Stoke-on-Trent.

Obituary.—MR. A. BASCOMBE.—The death recently took place at Falmouth, at the age of 66, of Mr. Alexander Bascombe, who had been connected with the telephone service for some 40 years. He was in the employ of the National Telephone Co., and rose step by step until he became executive engineer for the city of London.

MR. W. H. HITCHCOCK.—We regret to learn of the death, which took place on June 26th, of Mr. W. H. Hitchcock, of Siemens and English Electric Lamp Co., Ltd., London. He had been associated with Messrs. Siemens for some 25 years, and since 1919 had been manager of their branch at Newcastle-on-Tyne. Mr. Hitchcock was highly esteemed by all his colleagues and will be sadly missed.

SIR W. R. BROOKE.—We regret to note from *The Times* "Deaths" column that Sir William Robert Brooke, K.C.I.E., late Director-General of Telegraphs in India, passed away on July 8th suddenly in London at the age of 82 years.

New Companies Registered.

Permion, Ltd. (198,849).—Private company. Registered June 25th. Capital, £100 in 1s. shares. To carry on the business of manufacturers and vendors of all kinds of electrical apparatus, whether for wireless telegraphy or telephony or otherwise, &c. The subscribers (each with one share) are:—A. Black, 99, Regent Street, W.1, electrical engineer; A. S. Moss, 99, Regent Street, W.1, wireless operator; E. P. Higgins, 99, Regent Street, W.1, gent. The first directors may be appointed by the subscribers. Solicitors: Lloyd, Richardson & Co., 18, Sackville Street, W.1. Registered office: 5 and 6, Regent Place, Regent Street, W.

Waltons Wireless (Newcastle-upon-Tyne), Ltd. (198,791).—Private company. Registered June 23rd. Capital, £2,500 in £1 shares. To take over the business of dealers in apparatus and accessories for wireless telegraphy and telephony, cycles, gramophones, musical instruments, and electrical fittings and apparatus carried on by Townhend's, Ltd., at 24, Gallowgate, Newcastle-upon-Tyne, as "Edwin O. Walton," and to adopt an agreement with J. G. Walton. The permanent directors are:—A. A. McConnell, "Henshelwood," Jesmond, Newcastle-upon-Tyne, accountant; F. Barr, "Craignetham," Three Mile Bridge, Gosforth, secretary; J. G. Walton, address not stated. Qualification, £25. Remuneration, £10 per annum divided between them. Secretary: F. Barr. Solicitor: T. V. Devey, 88, Westgate Road, Newcastle-upon-Tyne. Registered office: 24, Gallowgate, Newcastle-upon-Tyne.

Hartley Engineering Co., Ltd. (198,871).—Private company. Registered June 26th. Capital, £2,000 in £1 shares. To carry on the business of electrical dealers, factors and agents, manufacturers of, and dealers in fittings and accessories connected with radio or wireless telegraphy and telephony, &c. The first directors are:—J. M. Bein, 56, Belmont Road, Southampton, electrical engineer; E. F. Catton, 2, Commercial Road, Southampton, electrical engineer; A. J. Curtis, 30, Castle Road, Salisbury, engineer; A. H. Powdrill, "Medina," 20, Leighton Road, Itchen, Southampton, accountant. Registered office: 110, High Street, Southampton.

North British Aluminium Co., Ltd. (198,866).—Registered on June 26th as a public company, with a nominal capital of £750,000 in £1 shares. The objects are:—To undertake the construction, erection, and equipment of all or any part of the works authorised by the Lochaber Water Power Act, 1921; to acquire land and erect and equip works or buildings for the production or manufacture of aluminium or other metals; to produce and manufacture such metals; to deal in engines, motors, rolling stock, machinery and appliances of all kinds, &c. The subscribers (each with one share) are:—R. T. Outen, 176, Stapleton Hall Road, Stroud Green, N.4, solicitor; J. W. Honess, 54, Pendle Road, Streatham, S.W.16, private secretary; and five clerks. Minimum cash subscription, 7 shares. No persons had consented to act as directors to June 25th. During the period of any loan raised by the company and guaranteed by the Treasury under the Trade Facilities Act, 1921, the Treasury shall have the right to a representative on the board, who shall be called an "ex-officio" director, with £500 per annum as remuneration. Qualification of directors, £500. Remuneration as fixed by the company. The amount borrowed by the directors and remaining outstanding at any time shall not, without the sanction of a general meeting, exceed £3,000,000. Solicitors: Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C. No notice of situation of registered office was filed at the time of incorporation.

S. L. Price & Co., Ltd. (199,001).—Private company. Registered July 1st. Capital £1,000 in £1 shares. To carry on the business of electrical, mechanical, automobile and general engineers, manufacturers, importers and exporters of and dealers in wireless detectors and valves, wireless, radio and electrical instruments, &c. The subscribers (each with one share) are:—P. H. Blackman, 26, Glasslyn Road, Crouch End, N.8, solicitor's articled clerk; V. Deighton, 1, Willifield Parade, Golders Green, N.W.11, solicitor's clerk. The first directors are: S. L. Price, W. J. Herwel, and G. E. Millner (all permanent). Registered office: 27, Cheapside, E.C.

Cable and Metals, Ltd. (198,927).—Private company. Registered June 28th. Capital, £1,000 in £1 shares. To carry on the business of engineers, dealers in engineering and allied products, particularly cable work, manufacturers, repairers, renovators and layers of cables, electricians, &c. The subscribers (each with one share) are:—E. D. Grove, 28, Keslake Road, Kilburn, N.W.6, clerk; F. D. Coulson, 32, Collingwood Avenue, Muswell Hill, N.10, clerk. The subscribers are to appoint the first directors. Solicitor: A. M. Oppenheimer, 31, Queen Victoria Street, E.C.4. Registered office: 31, Queen Victoria Street, E.C.4.

A. Franks (Wholesale), Ltd. (198,972).—Private company. Registered July 1st. Capital, £10,000 in £1 shares. To carry on the business of manufacturers and importers of and agents for the sale of dynamos, magnetos, accumulators, batteries, carburettors, valves, internal-combustion and other engines and all accessories and tools used in the engineering and motor trades; manufacturers, importers and distributors of and dealers in wireless instruments, sets, parts, gramophones, electrical fittings and apparatus, kinematograph fittings, &c. The first directors are:—M. H. Saffer (managing director), King Street, Manchester; J. D. Norman, 10, Rathen Road, Withington, Manchester; Mrs. Aimee A. Saffer, Westbrook, Birch Grove, Rusholme; Mrs. Fanny Franks, 136, Wellington Road, Withington, Manchester (director of A. Franks, Ltd.) (all permanent, subject to holding 1,000 shares each). Solicitors: Wood & Lord, 53, Deansgate Arcade, Manchester, and 21, Bucklersbury, E.C.4. Registered office: 3, South King Street, Manchester.

R. Roberts, Ltd. (198,964).—Private company. Registered June 30th. Capital, £1,000 in £1 shares. To carry on the business of electrical engineers, pressworkers, founders, engravers and workers in ebonite, erinoid and insulating material, metal dealers, manufacturers and factors of and agents for apparatus, components and instruments for the transmission and reception of wireless telephony and telegraphy, gramophones, gramophone records, cycles and accessories, &c. The first directors are:—R. Roberts, Flat 2, Cremorne Road, Four Oaks, Warwickshire, electrical engineer; G. Bayliss, 429, Bordesley Green, Small Heath, Birmingham, automobile engineer. Registered office: 53, Newton Street, Birmingham.

Wallace Magneto Repairing Co., Ltd. (199,004).—Private company. Registered July 1st. Capital, £2,000 in 2,000 shares of 10s. each and 800 shares of £1. To acquire the business of a magneto repairer and engineer now carried on by A. Danks as "The Wallace Magneto Repairing Co." The first directors are:—A. Danks (permanent director and chairman), 187, Walworth Road, S.E.17, electrical engineer; R. J. Chapple, 79, Moncrieff Street, Rye Lane, Peckham, S.E.15, engineer. Qualification, £200 shares. Remuneration of A. Danks, £400 per annum, of other directors as fixed by the company. Solicitor: T. H. Goodwin, 14, Coleman Street, E.C.

Aleon Radio Products, Ltd. (199,020).—Private company. Registered July 2nd. Capital, £1,000 in £1 shares. To carry on the business of wholesale and retail manufacturers of "loud speakers," horns or other sound producing or reproducing apparatus and all other apparatus for acoustic purposes or for radio telegraphy, &c. The first directors are:—M. Abrahams, 132, Cannon Street Road, Commercial Road, E.1; Mrs. R. Abrahams, 132, Cannon Street Road, Commercial Road, E.1; A. Abrahams, 132, Cannon Street Road, Commercial Road, E.1. Solicitor: G. H. Monson, 51-2, Chancery Lane, W.C.2. Registered office: 7F Building, Cambridge Avenue, Trading Estate, Slough, Bucks.

Racon Electrical Co., Ltd. (199,012).—Private company. Registered July 2nd. Capital, £100 in £1 shares. To carry on the business of wholesale and retail manufacturers of "loud speakers," horns or other sound producing or reproducing apparatus and all other apparatus for acoustic purposes or for radio telegraphy, &c. The first directors are:—M. Abrahams, 132, Cannon Street Road, Commercial Road, E.1; Mrs. R. Abrahams, 132, Cannon Street Road, Commercial Road, E.1; Myron M. Studner, 14, Greene Street, New York, U.S.A. Solicitor: G. H. Monson, 51-2, Chancery Lane, W.C.2. Registered office: 7F Building, Cambridge Avenue, Trading Estate, Slough, Bucks.

Official Returns of Electrical Companies.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Acknowledgement of further indebtedness dated May 30th, 1924 (supplemental to trust deed dated October 16th, 1913), to secure £100,000 additional second mortgage debenture stock ranking *pari passu* with £1,276,000 like debenture stock secured by the trust deed, as modified by a supplemental trust deed dated December 9th, 1921, and previous acknowledgements of indebtedness, constituting a specific charge on electrical undertakings and land, and shares in Carville Site and Power Co., Ltd., which may be acquired by the company, and a floating charge on the company's undertaking and property, present and future, except uncalled capital, subject to first mortgage debentures. Trustees: Law Debenture Corporation, Ltd.

Yorkshire Incandescent Electric Lamp Co., Ltd.—J. A. Couper, of 17, East Parade, Leeds, ceased to act as receiver or manager for the second mortgage debenture holders on June 19th, 1924.

Baxter & Caunter, Ltd.—Mortgage and collateral debenture, both dated June 23rd, 1924, to secure £5,000, charged on 219, Tottenham Court Road, and 8, Alfred Place, Store Street, W., the company's undertaking and property, present and future, including uncalled capital. Holder: G. W. Kettlewell, 219, Tottenham Court Road, W.1.

Orling's Telegraph Instruments Syndicate, Ltd.—Issue on June 26th, 1924, of £50 debentures, part of a series already registered.

Whitehall Electric Investments, Ltd.—A trust deed dated June 20th, 1924 (supplemental to trust deed dated April 13th, 1922), to secure £3,500,000 debenture stock, including £2,500,000 already registered, constituting a specific charge on the bonds secured by the original deed, and £1,000,000 7 per cent. first mortgage bonds of Compania de Electricidad de Valparaiso, £700,000 7 per cent. first mortgage bonds of Compania Hidro-Electrica, and £500,000 8 per cent. mortgage bonds of the Compania Chilena de Electricidad Limitada and a floating charge on the company's undertaking and property, present and future, including uncalled capital, has been registered. Trustees: London City and Midland Executor and Trustee Co., Ltd., and the Rt. Hon. Viscount Cowdray, P.C.

West Gloucestershire Power Co., Ltd.—Particulars filed of £600,000 debenture stock authorised June 25th, 1924, and covered by trust deed of even date charged on freehold land near Upper Forge Mill, Lydney, Glos., and buildings, plant, machinery, and fixtures thereon, and the company's undertaking and property, including uncalled capital, the amount of the present issue being £300,000. Trustees: British Empire Trust Co., Ltd., Stafford House, 14-20, King William Street, E.C.4.

Expert Electrical Co., Ltd.—A. J. Davis, of 36, King Street, Cheapside, E.C., ceased to act as receiver or manager on June 28th, 1924.

Egham and Staines Electricity Co., Ltd.—Mortgage debenture dated June 27th, 1924, to secure £30,000, charged on the company's undertaking and property, including uncalled capital, land at Egham, plant, machinery, &c. Holder: Solicitor for H.M. Treasury.

North Wales Power Co., Ltd.—Satisfaction to the extent of £220,470 on February 26th, 1924, of trust deed dated July 29th, 1919, and a second supplemental trust deed dated November 2nd, 1921, securing £1,000,000.

Nalder Bros. & Thompson, Ltd. (62,214).—Return dated February 20th, 1924. Capital, £30,000 in 15,000 preference and 15,000 ordinary shares of £1 each. 12,000 preference and 11,881 ordinary shares taken up. £13,881 paid. £10,000 considered as paid. Mortgages and charges at date of return, nil. Since registered, land registry charge dated May 19th, 1924, to secure banking account.

Hastings and District Electric Tramways Co., Ltd. (62,321).—Return dated April 22nd, 1924. Capital, £372,942 16s. in 130,000 preference of £1 each and 485,885 ordinary shares of 10s. each. 80,000 preference and 268,235 ordinary shares taken up. £300,000 paid on 80,000 preference and 240,000 ordinary shares. £14,117 16s. considered as paid on 28,235 ordinary shares. Mortgages and charges, £250,000.

P. R. Jackson & Co., Ltd. (35,232).—Return dated April 14th, 1924. Capital, £60,000 in £1 shares. All shares taken up. £1 per share called up on 11,410 and 6s. per share on 19,000 shares. £17,110 paid. £42,890 considered as paid, being £1 per share on 29,590 and 14s. per share on 19,000 shares. Mortgages and charges, nil.

Yorkshire (West Riding) Electric Tramways Co., Ltd. (84,167).—Return dated April 11th, 1924. Capital, £600,000 in 350,000 preference and 250,000 ordinary shares of £1 each. 231,305 preference and 204,885 ordinary shares taken up. £436,190 considered as paid. Mortgages and charges, £272,373.

River Plate Electricity Co., Ltd. (75,569).—Return dated May 16th, 1924. Capital, £500,000 in 150,000 preference and 350,000 ordinary shares of £1 each. 150,000 preference and 347,013 ordinary shares taken up. £105,433 paid on 50,000 preference and 55,433 ordinary shares. £391,580 considered as paid on 100,000 preference and 291,580 ordinary shares. Mortgages and charges outstanding, £159,500 5 per cent. debenture stock (part of £250,000 authorised).

City of Carlisle Electric Tramways Co., Ltd. (62,601).—Return dated February 28th, 1924. Capital, £60,000 in £1 shares. All shares taken up. £60,000 paid. Mortgages and charges, £40,000.

City Notes.

Crompton and Co., Ltd.

The directors report that the net profit for the year ended March 31st, 1924, after providing for depreciation, interest on debentures, directors' fees, &c., was £1,714, plus £1,090 brought forward, making £2,804. There has been added to this, transferred from the reserve account, £8,500, making £11,304. The dividend of 7 per cent. on the preference shares absorbs £11,304, leaving £1,458 to be carried forward. Meeting: London, July 10th.

The report for the year ended March, 1923, showed a loss of £7,185, but there was £18,084 brought in from the previous year, the available balance therefore being £10,898, out of which the preference dividend was paid, leaving £1,090 to be carried forward.

The profit and loss account now issued shows as follows:—By profit from trading, dividends on investments, &c., less administration and general charges, deprecintion and reserves for bad and doubtful debts, £11,551. Interest on debentures absorbed £7,194; directors', trustees' and auditors' fees, £2,644; leaving the net profit carried to balance sheet, as above, £1,714. In the balance sheet, stock-in-trade and work in progress, at cost or under, figure at £209,132, and sundry debtors and debit balances (less reserve), including balances of the Indian and Colonial Branch accounts at £209,807. On the other side of the account, reserve account stands at £66,500; there is a bank loan of £37,500; and sundry creditors and bills payable, including reserves for taxation, stand at £142,610.

Oriental Telephone & Electric Co., Ltd.

Sir George S. Gibb presided at the annual meeting on July 2nd, and in moving the adoption of the report and accounts (*vide* ELECTRICAL REVIEW, June 27th, p. 1055), reviewed the history and scope of the company's activities. He stated that a new agreement had been arrived at with regard to the Singapore telephones, by which the Government surrendered its right to terminate the licence before 1944. In India, Rangoon, and Singapore, therefore, the company was secure in its licence rights until 1943 or 1944. Negotiations were in progress in Hong Kong and Mauritius, and it was believed that satisfactory arrangements would result. The chairman made reference to the large capital expenditure which had been made in the past few years, and stated that in Bombay, Calcutta, and Singapore they had reached the stage at which the raising of further capital was a matter which would not concern them for a long time ahead. The position as regarded charges was not so satisfactory, but it was moving in the right direction. The adoption of the message rate was a wise decision; no telephone undertaking could develop on uniform flat rates under modern conditions. Arrangements had been made to advance on temporary loan about £140,000 to the Madras and Rangoon Companies for their proposed works. They were not in a position to estimate what would be required at Hong Kong, but there was ample provision for requirements in the near future. There had been a falling off in the number of subscribers in Calcutta, Madras, and Rangoon, but the position would be recovered when the new rates were introduced. The Madras Government had decided to close its own telephone system and transfer the whole of the subscribers to the company. The company, he stated, in con-

clusion, had ample reserves, and the Rangoon and Madras companies would set aside depreciation reserves in their accounts as the other subsidiary companies did.

Delhi Electric Tramways and Lighting Co., Ltd.

This company, whose report and accounts were abstracted in our last issue (p. 32), held its annual meeting on July 2nd. Mr. R. Carroll Pearman, who presided, in the absence of Mr. A. W. Tait, through illness, said, with regard to the electricity supply undertaking, that there had been no change in the charges. The number of consumers connected had increased by 853 to 4,718. Owing to the increase in the proportion of energy sold for power purposes the average revenue per kWh had declined from 4.80 to 4.68 annas. The energy sold increased from 3,114,000 to approximately 3,400,000 kWh; 82¼ per cent. of this was generated by the Diesel plant. Although the price of oil fuel had fallen, the rates for coal and oil were still high. Notwithstanding the addition of 820 kW of plant during the year, there were still over 180 consumers awaiting connection; a further 670 kW of Diesel plant was being added during the current year. The steam plant costs were excessive, but it had not been possible to dispense with it altogether. No additions had been made to the tramway system during the year, but the effects of the improvements carried out in previous years had been felt. The current consumption had been reduced from 1.37 to 1.24 kWh per car mile, while the expense ratio had fallen from 82.47 to 75 per cent. With regard to the prospects for the current year, the chairman said that the figures so far received were favourable in both the supply and tramway sections, and there was every reason to hope for further improved results.

London "Underground" Railways.

Interim dividends have been declared by the "Underground" group as follows:—*London Electric Railway Co.*—Two per cent. on the ordinary shares, as in 1923. *City & South London Railway Co.*—Two per cent. on the consolidated ordinary stock, as in 1923.

Metropolitan District Railway Co.—One-and-a-half per cent. on the ordinary stock, as in 1923.

Central London Railway Co.—Two per cent. on the undivided ordinary stock, and 2 per cent. on the preferred ordinary stock, as in 1923.

Underground Electric Railways Co. of London, Ltd.—Three per cent. on the 6 per cent. income bonds, as in 1923.

The Associated Equipment Co., Ltd., is again paying no interim dividend, while the *London General Omnibus Co.'s* interim dividend on the ordinary shares is reduced from 4½ per cent., free of tax, to 3 per cent., free of tax.

American Westinghouse Co.

The authorised capital stock of the Westinghouse Electric and Manufacturing Company was increased from $125,000,000 par value to $200,000,000 par value at a meeting of the stockholders held on June 11th at East Pittsburgh, Pa. Mr. E. M. Herr, president of the company, said that the condition of business in the electrical industry was quite satisfactory, especially considering the tendency of industry in general to slow up at the present time. While their business was somewhat less than for the corresponding period a year ago, the decrease had not been of sufficient volume to materially affect their operations, and their commercial people believed that it would improve in the autumn—to what extent of course depended somewhat upon the result of the political campaign.

Barcelona Traction, Light, and Power Co.

A meeting of the company will be held in Toronto on July 24th to approve of the increasing of the capital by the creation of additional $100 seven per cent. non-cumulative participating preference shares to the extent of $17,500,000, and the reduction of the par value of the ordinary shares to $50. The net result of these alterations will be to increase the company's capital by $2,500,000 to $45,000,000.

German Companies.

The *C. Lorenz Telephone and Telegraph Works Company*, of Berlin, has decided to transfer the paper profits of 1923 to an equalisation fund for the losses incurred during the period of inflation.

The *Land and Sea Cable Works Company*, of Cologne-Nippes, reports that the degree of activity of the works at present is adequate and the general situation of the undertaking is satisfactory. The net paper profits earned in 1923 have been carried forward.

The report of the *Bergmann Electricity Works Company*, of Berlin, states that while almost all departments were occupied to the limit of their capacity in the first half of 1923, in the second half the costs of production exceeded the world's parity and orders experienced a considerable decline, and restrictions in working were carried out in order to avoid losses as far as possible owing to the depreciation of the mark. The central station department participated to a large extent in the extension of the networks for the electrification of Germany, especially in East Prussia and Bavaria. As a consequence of the incursion into the Ruhr the industrial departments suffered from a decline in orders from the mines and ironworks, although some compensation was afforded by a more active arrival of orders from the Central German mining industry and from abroad. The new contracts received from the chemical, textile, paper, machinery and other industries were satisfactory, while the railway department completed a number of high speed and goods locomotives and was still engaged on the execution of further and similar orders. Favourable development was taking place in electric vehicles for the transport of goods, the degree of activity in the steam turbine works was satisfactory, and the cable factory had important orders to carry out.

French Companies.

The *Compagnie des Etablissements Merlin et Gerin*, of Grenoble, states that the average monthly turnover in 1923 showed a large increase over the preceding year and working developed in a normal manner. Net profits 283,000 fr.; dividend at the rate of 6 per cent.

The *Compagnie Lorraine de Charbons, Lampes et Appareillages Electriques*, of Paris, reports that additions to the Pagny works were rendered necessary in 1923 in order to meet the regular execution of orders for electrical carbons and brushes. Profits 158,000 fr.; dividend at the rate of 5 per cent.

The *Société d'Electrochimie, d'Electrometallurgie et des Aciéries Electriques d'Ugine* records net profits of 4,764,000 fr. for 1923 and a dividend at the rate of 35 fr. per share. The markets for carbide of calcium considerably increased, while the transformation of carbide into cyanamide was being developed. The uses of aluminium continued to expand and the manufacture of ferro alloys gave excellent results.

The *Compagnie Francaise de Câbles Télégraphiques*, referring to the proposed cession of a part of the company's system to the south of New York to the All America Cables, Inc., states that this transaction was submitted for the approval of the competent French authorities, who, however, had not given the necessary authorisation down to July 1st. This statement, which was made at a meeting of the company on the latter date, was followed by the intimation that the extreme period fixed by the All America Cables would expire on July 31st and that the latter could resume its liberty to compete with the Compagnie des Câbles Transatlantiques after that date.

The *Compagnie de Produits Chimiques et Electrometallurgiques Allais, Froges et Camarges*, states that 1923 was more favourable than 1922. In the case of aluminium the home market assumed such amplitude that the company was only able to supply a very much reduced tonnage for export in response to the demands of foreign customers. It was proposed to increase the share capital from 160,000,000 to 200,000,000 fr. in order to improve the efficiency of the existing works and ensure the equipment of new falls in the near future. During the first five months of 1924 the sales of aluminium developed considerably.

The *Compagnie des Constructions Electriques de France* states that the works reached a normal degree of production in December, 1923. During the year the company continued the construction of passenger and goods locomotives for various railways, and created an absolutely new type of high speed electric locomotive. Two of the locomotives which were delivered in the second half of last year were subjected to official trials in December over a considerable distance, and at the close of the tests the Compagnie des Chemins du Midi placed an order for eight further locomotives of the same type. All the constructional operations at the works at Tarbes and Lyons were completed and the concentration and distribution of manufacturing between the two works, was carried out; specialisation of the works had been realised while permitting each establishment to assist the other in case of necessity. The production of the traction department had reached the monthly level of six electric locomotives and this could be exceeded without enlarging the buildings. For the rest the department was adequately supplied with orders for tramway plant and electric omnibuses. In the case of the hydraulic department the company, independently of the execution of orders for 175,000 h.p. of turbines for France, had received important orders for export markets. An ample supply of work was on hand for the department producing alternators for hydraulic turbines, high-pressure rotary converters for sub-stations, &c.

The *Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston*, whose decision to pay a dividend at the rate of 45 fr. per share for 1923 has previously been reported, states that during the year the company received orders, among others, for turbo-alternators of from 10,000 to 25,000 kW, high-pressure transformers and switchboards, winding engines and large motors for rolling mills. After referring to the sub-station works carried out for French railways and the setting in operation of electric motor coaches already delivered, the report states that the result achieved, or on the eve of being attained, would permit the railways to embark upon new parts of their programme and place the company in a privileged position for participating in their realisation. The equipment of waterfalls had also entered upon a phase of great activity and the company now foresaw new and important applications of heavy electrical machines.

Aron Electricity Meter, Ltd.—The report for the year ended March 31st last shows a net profit of £10,923. To this is added £5,748 brought forward, making £16,671. As previously announced, a dividend of 6 per cent. has been paid on the preference shares, wiping out the arrears to March 31st, 1921, and in addition to this a further 12 per cent. is being paid, leaving the dividend one year in arrear. A balance of £2,256 is being carried forward.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Lancashire Electric Light and Power Co.—28,585 ordinary shares of £1 each, fully paid, Nos. 152,339 to 152,363 and 250,001 to 278,560.

West Gloucestershire Power Co.—300,000 6½ per cent. participating preference shares of £1 each, issued at £1 0s. 6d., partly paid and fully paid, Nos. 1 to 300,000, and £300,000 5½ per cent. first mortgage sinking fund debenture stock, issued at 97½ per cent., partly paid and fully paid.

The undermentioned securities have been ordered to be officially quoted:—

British Columbia Electric Railway Company.—£770,000 five per cent. (income tax free) 1944 debenture stock.

Lancashire Electric Light and Power Company.—628,560 ordinary shares of £1 each, fully paid, Nos. 1 to 628,560, and 350,000 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 212,501 to 562,500.

Telephone Manufacturing Company.—£300,000 guaranteed 8 per cent. cumulative income bonds, Nos. A1 to 2,656 (£100), B1 to 517 (£50), and C1 to 855 (£10) (registered).

United River Plate Telephone Company.—108,000 ordinary shares of £5 each, fully paid, Nos. 540,001 to 648,000.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—Mr. G. H. Fookes, one of the joint trustees, presided at a meeting of the debenture holders on July 7th, when proposals for altering the trust deed were considered. The principal resolution related to a new clause whereby the company acknowledged its indebtedness to the trustees in the sum of £150,000, and agreed to the payment of interest at the rate of 6 per cent. on that amount. Mr. Christopher Ogle, who, at previous meetings, had raised the point of the amount which the directors were justified in allocating to depreciation, tendered his resignation, which was accepted. All the resolutions received the approval of the meeting.

Prospectus.—*British Automobile Traction Co., Ltd.*—This company has this week been offering for subscription an issue of £250,000 5½ per cent. first debenture stock at £95 per cent. The proceeds will be used for the further development of the various omnibus services of the company. The B.E.T. Co. and Thomas Tilling, Ltd., hold 70 per cent. of the total issued share capital of £500,000, and they have underwritten the present issue.

Rees Roturbo Manufacturing Co., Ltd.—The accounts for the year ended September 30th, 1923, show that the amount available, after bringing in £5,000 from general reserve, £7,000 from the taxation reserve, and £5,342 from the preceding year, and transferring £3,000 to depreciation reserve, was £582. A sum of £1,572 has been added to capital expenditure for tools, &c.

J. Stone & Co., Ltd.—The balance to credit of profit and loss for 1923 is £165,340 plus £147,591 brought forward. The preference dividend is paid, £75,000 is put to reserve, 10 per cent. dividend is to be paid on the ordinary shares, and £138,891 is carried forward.

General Electric Co., Ltd.—The annual meeting of this company was held on Tuesday, at Magnet House. Mr. Hirst presided. The report was adopted. We shall publish an account of the proceedings next week.

Northern Mexico Power and Development Co.—The accounts for 1923 show net earnings $293,193, increasing the credit brought in to $887,103. A dividend on 7 per cent. preference shares for 1920 is now declared.—*Financial News.*

Reduction of Capital.—SERCK RADIATORS, LTD.—A petition has been presented to the High Court for the confirmation of the reduction of capital of the above named company from £200,000 to £120,000, and will be heard in London on July 25th.

Bournemouth & Poole Electricity Supply Co., Ltd.—An interim dividend of 4½ per cent. has been declared on the ordinary shares, as against 3½ per cent. last year. The new ordinary shares will participate in this to the extent of the instalments paid at June 30th.

Greenwood & Batley, Ltd.—The directors have declared a final dividend of 2½ per cent., making 5 per cent. for the year, as in 1922-23.

Metropolitan Electric Supply Co., Ltd.—Interim dividend on ordinary shares in respect of current year's working at the rate of 6 per cent. per annum.

Telegraph Construction & Maintenance Co., Ltd.—Interim dividend of 6s. per share, free of tax.

Notting Hill Electric Lighting Co., Ltd.—Interim dividend of 4s. per share, tax free, on the deferred shares.

Stocks and Shares.

MONDAY EVENING.

THE fear of a rise in the Bank Rate hangs dully over most of the investment markets. Stock Exchange men looked for an advance to be made last Thursday, but, this not materialising, general opinion carried over the expectation for another week, and it is held that the Rate may go to 5 per cent. on this Thursday. The consideration has the effect of making gilt-edged stocks lean to the lower side, and a good many of the fixed-interest securities in the Home Railway group are a point or two down.

On the other hand, Underground Electric income bonds have jumped up no less than 6 points to 97, on the unexpected declaration of a dividend in full, namely, 3 per cent., on these bonds. A week ago, the market talked of a possible 2 per cent., and the announcement of the full 3 per cent. is regarded as being made at the expense of London General Omnibus stock, which is to receive 3 per cent. free of tax, comparing with 4½ per cent. free of tax a year ago. The interim dividend on District ordinary stock is to be 1½ per cent.; on London Electrics 2 per cent., and the latter rate is also declared on City & South London and Central London ordinary stocks, these all being at the same rates as those of July, 1923. Considering the statement made by Lord Ashfield, which we mentioned a week ago, at the time of the tram and 'bus strike, the announcement of 3 per cent. on Underground incomes comes in the nature of a pleasant surprise. The ordinary shares at 2½ are ¼ up. Districts rose to 51½ and Metropolitans remain steady at 80. East Londons came in for a certain amount of attention, the price strengthening to 5½, on rumours, revived for the nth time, that the little line is going to be taken over by some of the bigger brethren at a price which will well compensate holders of the East London debenture stocks and of the ordinary.

In the matter of new issues, it is tolerably evident that stagging will lose a good deal of its attraction if underwriters continue to be left with stock to the same extent as they have been of late. Barcelona Traction Prior-lien bonds have fallen to 2½ discount. Whitehall Electric new preference are dull at 1s. discount, and the debenture stock, which came out at 94, is ¾ discount, although the underwriters were relieved of their responsibilities in respect of the latter. West Gloucestershire Power debenture, where the underwriters received 50 per cent., is 3 discount, and the preference shares, with which they were left to the extent of about 85 per cent., are 1s. 6d. discount. Madras Electric Tramways new debentures stand at about 7s. 6d. discount; on the other hand, Shropshire Electric debentures can be sold at 2½ discount, which is a better price than obtained last week. The public have become more discriminating in applying for new issues, and, with so many stags about who are anxious to get out of stock they do not want, the cry again goes up that markets are threatened with financial indigestion. A new issue by the County of London Electric is said to be at hand. Interest is curious to see how the market will open in the new 5½ per cent. debenture stock, of which £250,000 has just been offered at 95, by the British Automobile Traction Company. Over 70 per cent. of the issued share capital of £500,000 is held by the British Electric Traction Company, Ltd., and Thomas Tilling, Ltd.

Notting Hill Electric has declared a dividend of 4s. net; St. James' interim dividend is at the rate of 10 per cent. (the same as that of last year), Bournemouth and Poole at the rate of 9 per cent., comparing with 7 per cent., and Yorkshire at the rate of 6 per cent., showing no change. Prices in the Electricity Supply market are very firm, without showing particular change. In fact, the only movement is a small rise in Newcastle-on-Tyne 7 per cent. preference to 24s. 6d. Edmundson's, as already notified, are going to reinstate the £2 previously written off the ordinary shares, in order to bring up the latter to £5 again, and, when this is done, the whole issue will be converted into £1 shares. The effect had been discounted, and no change occurred in the price of either the ordinary or the preference. At this time of the year, investment requires a good deal of persuasion before it will take interest in stocks and shares of companies connected with illumination. Accordingly, in the Stock Exchange it is considered satisfactory to find prices holding up as well as they do at the present time.

Despite the monetary flurry, a number of debenture stocks have hardened. City of London Fives are better at 98, and the second debenture at 86. St. James' 3½ per cent. debenture strengthened to 67½. Tokio Electric Sixes gained 1½ at 88½. Newcastle and District 4½ per cent. first debenture is better at 85½. Anglo-Argentine 5 per cent. debenture at 74½ is a point higher.

Cable stocks maintain their substantial recovery of a week ago, Western Telegraphs being the only exception; at 16½ the price is 5s. lower. Marconis developed strength on the hope of the Government's joining hands with the company in a comprehensive scheme of international wireless development. An announcement is said to be imminent. Canadian Marconis put on sixpence at 4s. 9d. Marconi 7 per cent. debenture stock is rather harder at 102½.

Aron Electricity Meter preference rose to 16s. 6d. The directors have declared a further 12 per cent. dividend on account of arrears, which brings the payment up to the end of March, 1923. The ordinary shares are quoted at 8s. 9d. middle. General Electrics have gone back to 18s. 9d., the same price as Siemens. English Electrics drooped to 16s.

British Electric Traction ordinary went up to 96 before reverting to 95, which still is 2 higher on the week. The company's preference at 104½ has risen a point. Brazilian Tractions, on rumours of a revolution subsequently declared to have been "cancelled," are down 1½. Mexicans are very heavy, owing to the disappointment felt at the non-arrival of funds to meet interest on certain Mexican Government bonds. Lisbon Electric Trams changed hands to-day, Monday, at one-and-sixpence. Singapore Tramway ordinary at 7s. constitute a Stock Exchange anomaly as compared with the company's debenture stock at 80. It is said that the shares have been run up unduly upon demand from Chinese speculators.

Engineering and allied shares are quiet, but not a bad market. A faintly better tendency is observable amongst rubber shares; there is, however, no increase of public business in their department.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1922.	Dividend. 1923.	Price July 7, 1924.	Rise or fall.	Yield. £ s. d.
Brompton Ordinary	1	12	10	37/-	—	*£5 8 1
Charing Cross Ordinary	1	14	14½	42/-	—	6 18 2
do. do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	10	12	37/6	—	6 8 0
City of London	1	15	15	45/9	—	6 11 0
do. do. 6 % Pref. ...	1	6	6	23/6	—	5 2 2
County of London	1	10	15	49/6	—	6 1 0
do. do. 6 % Pref. ...	1	6	6	1¼	—	5 6 8
Edmundson's Ordinary	3	7	7	5	—	4 4 1
do. 6 % Pref.	5	6	6	5⅝	—	5 11 7
Kensington Ordinary	5	13	14	9½	—	7 3 7
London Electric	1	10	10	31/-	—	6 9 0
do. do. 6 % Pref. ...	5	6	6	5⅝	—	5 11 7
Metropolitan	1	8½	10	12	—	5 14 3
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	2½	6	18/9	—	6 8 1
do. 5 % Pref. ...	1	5	5	17/-	—	5 17 8
do. 7 % Pref. ...	1	7	7	24/6	+6d.	5 14 3
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	21/3	—	5 13 0
Urban Ordinary	1	—	4	19/3	—	4 3 1
do 6 % Pref. ...	1	5	6	1	—	6 0 0
St. James' and Pall Mall ...	5	14½	17½	13⅜	—	6 10 10
South London	1	11	15	43/3	—	6 18 7
South Metropolitan Pref. ...		7	7	1¼	—	5 12 0
Westminster Ordinary	5	12	15	10½	—	7 6 4
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	20/6	—	7 6 4

HOME RAILS.

Central London Ord. Assented Stock	4	4	68½	—	5 16 10
Metropolitan ... ... ,,	3½	4	80	—	5 0 0
do. District ... ... ,,	3	3½	51½	+ ½	6 16 0
Underground Electric Ordinary	10	Nil	Nil	2⅜	+ ⅛	Nil
do. do. "A" ...	1	Nil	Nil	7/8	—	Nil
do. do. Income Bonds	5	6	97	+6	*6 3 9

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref. ... ... Stock	6	6	109½	—	5 16 0
do. Def. ... ... ,,	1½	1½	23⅞	—	6 6 4
Chile Telephone	5	6	6	6¾	—	4 9 0
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension...	10	10	10	16⅜	—	5 19 5
Eastern Tel. Ord.	Stock	10	10	167½	—	5 19 5
Globe Tel. and T. Ord.	10	10	10	17½xd	—	5 14 3
do. do. Pref.	10	6	6	11½xd	—	5 7 10
Great Northern Tel.	10	24	22	27½	—	8 0
Indo-European	25	7	7	32½	—1	*5 6 1
Marconi	1	15	—	1 7/8	+ 1/8	9 12 0
Oriental Telephone Ord.... ...	1	12	12	1½	—	*6 3 9
United R. Plate Tel.	5	8	8	6⅜	—	*5 18 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16½	— ¼	6 1 3

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref....	5	12½	5½	8 1/16	—	8 12 6
do. do. 2nd Pref. ...	5	5½	6	9 1/16	—	10 4 4
do. do. 5% Deb. ...	Stock	5	5	74½	+1	6 18 0
British Electric Traction Ord. ...	,,	5	6	95	+2	6 6 4
do. do. 6% Pref. ...	,,	6	6	104½	+1	5 16 0
Brazil Traction	100	4	4	58	—1½	6 18 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	87½	—	5 14 3
do. do. Preferred	,,	5	20/-	83½	—1	*5 15 3
do. do. Deferred	,,	8	127/-	100½	—	*6 8 6
do. do. Deb.	,,	4½	4½	81½	—	5 4 4
Lond. & Sub. Trac. 5 % Pref. ...	1	5	2½	7/-	—	7 2 10
London United Tram. Deb. ...	Stock	4	4	47	—	8 10 2
Mexico Trams. 5% Bonds ...	—	Nil	5	70½	—	7 1 10
do 6% Bonds ...	—	Nil	Nil	47½	—1	Nil
Mexican Light Common ...	100	Nil	Nil	18	—	Nil
do. Pref.	100	Nil	Nil	44	—	Nil
do. 1st Bonds ...	—	5	5	83½	—	7 17 6

MANUFACTURING COMPANIES.

Babcock & Wilcox...	1	20	12	47/6	—	*5 1 2
British Aluminium Ord.... ...	1	5	5	25/-	—	4 0 0
British Insulated Ord.	1	15	15	2⅝	—	5 14 3
Callenders	1	15	15	2 7/16	—	5 17 0
do. 6½ Pref....	1	6½	6½	23/3	—	5 11 10
Crompton Ord.	1	5	—	5/16	—	8 17 10
Edison-Swan	4/-	7½	—	5/-	—	6 0 0
do. ,, 5% Deb.	Stock	5	5	75½	—	6 12 5
Electric Construction	1	10	10	1½	—	6 13 4
English Electric	1	8	5	16/-	—9d.	6 5 0
do. do. Pref.	1	6	6	19/6	—	6 3 1
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	5	18/9	—1/6	5 6 8
Henley	1	15	15	2 1/16	+ 1/16	5 11 6
do. 4½ Pref.	5	4½	4½	4½	+ ⅛	5 6 0
India-Rubber	1	10	—	1½	—	*7 5 6
Met.-Vickers Pref....	2	8	8	2 7/16	—	6 11 2
Siemens Ord.	1	5	—	18/9xd	—	5 6 8
Telegraph Con.	19	20	20	24½	—	*4 17 7

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price July 8.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	5½d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£125 to £130	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		...
Grade I ... ... per ton net	£211	£3 inc.
Grade II ... ... ,, ,,	£152	£3 inc.
Grade III ... ... ,, ,,	£86	...
c Brass (rolled metal 2" to 12" basis) per lb.	9⅜d.	...
c ,, Tubes (solid drawn) ... ,,	11¾d. to 1/-	½d. dec.
c ,, Wire, basis ... ... ,,	9⅝d.	...
c Copper Tubes (solid drawn) ... ,,	1/1	½d. dec.
c ,, Bars (best selected) ... per ton	£92	...
c ,, Sheet ... ... ,,	£92	...
c ,, Rod ... ... ,,	£92	...
d ,, (Electrolytic) Bars ... ,,	£65 5s.	15s. dec.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£75 5s.	15s. dec.
d ,, ,, H.C. Wire per lb.	9 1/16d.	½d. dec.
f Ebonite Rod ... ... ,,	2/- to 3/6	...
f Sheet ... ... ,,	2/- to 3/6	...
n German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	nmm.	...
h India-rubber, Para fine ... ... ,,	11d.	...
Iron Pig (Cleveland Warrants) ... per ton.	£5 2s. to £5 2s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ... ... ,,	£33 10s.	...
g Mercury ... ... per bot.	£13 to £13 5s.	...
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	½d. dec.
p ,, ,, rolled strip & sheet ,,	1/3½	...
p ,, ,, wire ... ... ,,	1/3¾	...
o Platinum ... ... per oz.	£26	...
d Silicium Bronze Wire ... ... per lb.	1/0½	...
r Steel, Magnet, in bars ... ... ,,	8d.	...
n Tin, Block (English) ... ... per ton.	£227 to £227 10s.	30/- to £2 inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Photographing Projectiles in Flight.—It is possible to obtain a photograph of a projectile in flight with a commercial kinematograph camera provided an exposure can be made at the right instant. Generally, however, the image will be blurred owing to the rapid motion of the projectile. Special cameras have been developed for the purpose, but these were designed for specific and very limited uses. These can be divided into two classes—those which use an electric spark for illumination and those which depend upon daylight. The staff of the United States Bureau of Standards has designed a camera which makes it possible to study the "yaw" of the projectile, its velocity, and its speed of rotation (Technologic Paper No. 255). In this a sensitive film is mounted on a drum which can be made to rotate at such a speed that the film moves with the estimated speed of the image of the projectile. The focal plane shutter drum rotates in the opposite direction and at a speed several times as great. An electrical circuit is arranged to open the main shutter by means of a magnet just before the projectile comes into the field of the camera. An attachment on the film drum breaks the circuit, so as to close the shutter when the film drum has made one revolution. When the projectile comes into the field of the camera with the main shutter open, an image is formed on the focal plane shutter drum. The speed of this drum is such that before the projectile leaves the field of the camera at least one of the openings in the shutter drum will pass the image, thus exposing the film. As the film and the projectile image are moving at approximately the same speed and in the same direction, there is no blurring or distortion of the picture.

Switch and Transformer Oil.

The Necessity of Inspection and Testing.

By C. SYLVESTER, A.M.I.E.E., A.M.I.Mech.E.

In a central station in Yorkshire the other day I happened to stroll round the high-pressure switchboard, and I noticed an attendant "topping up" a feeder cell oil switch with oil. I was particularly interested because, a few minutes before, I had seen the same attendant with the same oil drum releasing some of its contents into the oil tank of a turbine. I examined the oil and found it to be ordinary lubricating oil. The station attendant was not to blame, since his instructions were "to fill up tanks and switches," and he was apparently under the impression that oil was just oil. This will not cause wonderment when it is mentioned that the attendant's position was merely temporary, his usual occupation being to assist in the store; but it points to the necessity for central-station engineers keeping a close watch on the application of transformer and switch oil in more senses than one.

The keen central-station engineer is becoming more convinced of the necessity for making periodical inspections and tests of insulating oil and, in more than one power station, equipment has been acquired for dehydrating and purifying oil that has absorbed moisture or sediment. The successful results which have attended the installation of such equipment are quite evident when it is considered that failure of apparatus from burnouts, with consequent interruption of service, has been reduced to a minimum, and an economy in the use of oil has also been effected.

The correct application and treatment of transformer and switch oil is an important subject; in fact, if central-station equipment is to be maintained at a high pitch of efficiency, too much consideration cannot be given to oil characteristics. I have often seen transformer oil used for topping-up oil switches, and the impression has been that it will be quite satisfactory. This idea is wrong; although, in both cases, it must have a high dielectric strength and flash-point, the viscosity of the oil used for transformers must be low to allow free circulation, but in oil circuit-breakers the viscosity must be high to prevent undue splashing.

Clean, dry oil should have a dielectric strength of at least 40,000 volts, when tested between half-inch brass spheres set 0.15 in. apart. The dielectric strength, however, quickly decreases if it is allowed to absorb moisture. As a matter of fact, 0.01 per cent. of moisture is quite sufficient to seriously impair the dielectric strength of transformer or switch oil. This may account for breakdowns occurring through oil drums being allowed to lie about the station yard, or through transferring oil from one drum to another without first ascertaining that the drums are perfectly dry.

I have seen insulating oil, quite recently too, emptied directly from the drums into a transformer or oil switch. This should be avoided as far as possible, and the oil filtered before it is used. During transportation from the works to the central station, foreign matter, such as scale, &c., is likely to become dislodged, thus forming a deposit. The latter is objectionable because it clings to the windings in transformers and helps to fill the oil ducts. In this way the cooling of the apparatus is seriously affected. The deposit also renders the oil more sluggish, and thus further affects its cooling action.

The presence of acid or alkali in insulating oil is detrimental to the efficiency of the transformer or oil switch, and it is surprising, at times, how such foreign matter finds its way into the cases. It sometimes happens that a piece of waste is used for cleaning-out that has previously been used for wiping down in the battery room, or it may be that the waste has been stored near the fitting shop, where sulphur fumes are likely to cover it with a deposit of sulphur.

When acid or alkali is present in insulating oil the dielectric strength of the oil is reduced and, since both acid and alkali are destructive and corrosive in their action, the materials of which the apparatus is constructed will consequently suffer. All waste, before it is used in the central station, should be boiled and placed in the hydro extractor. This may appear to be an unnecessary precaution, but it will pay in the long run. The verdigris which may be detected creeping up inside the insulators on the switch contact pillars may be the result of using unclean waste.

No precautions can be too great to ensure all oil-handling apparatus being dry and clean, and to prevent moisture or dirt getting into the oil. For instance, a drum of cold oil, when taken from the store into a warm engine room, will invariably sweat, and the resulting moisture may mix with the oil as the latter is poured from the drum. To obviate this, the drum should be allowed to stand in the engine room for some time before the seal is broken; this should not be done until the outside temperature of the drum is at least the same as that of the room.

All oil, before use, should be passed through a filter press. Several thicknesses of muslin will be found to be suitable for this purpose; the muslin, however, should be thoroughly washed, rinsed, and dried to remove the size. Straining cloths should be renewed after each use, that is, not less than one set of clean cloths should be used for straining the oil for one switch or transformer.

It is well known that apparatus immersed in insulating oil requires much less attention than other electrical apparatus. It is because this is so well known that oil-immersed apparatus receives practically no attention at all. In fact, in some central stations it is considered that as long as apparatus in oil functions correctly it will do so for an indefinite period. The characteristics of any insulating oil are liable to be impaired after it has been in use for some time. For this reason it is most essential that periodical inspections and tests of oil should be made. The chief points in connection with such an inspection are a check on the oil level to determine loss by evaporation, and a check on deposits and dielectric strength.

Referring to the check on deposits, this applies particularly to transformers and oil circuit breakers; oil-cooled starters and rheostats may be neglected. Samples should be taken from the bottom of the cases and poured into a glass vessel, through which sediment or discolourations may be easily detected. If the oil is discoloured, it will be found that a deposit at least one-eighth of an inch thick will be upon the bottom of the case and, in all probability, a thinner deposit will be clinging to the sides of the case. If so, the oil should be filtered and the tanks thoroughly cleaned out.

The check on dielectric strength may be carried out upon samples taken and subjected to a voltage of 40,000 volts between one-half-inch brass spheres at a distance apart of 0.15 in. This test may also be carried out on discoloured oil, since, if it breaks down at 30,000 volts, it is necessary to filter it. After filtering, it should easily withstand 40,000 volts.

In conclusion, it may be said that the time between inspections and tests depends upon local conditions and upon the importance of minimising the interruption to service. In the Potteries, for instance, where clay dust abounds in large quantities, there is greater necessity for frequent inspection than, say, in leafy Warwickshire. No matter what the local conditions may be, the transformer and circuit breaker will not function correctly if adequate precautions are not taken with the insulating oil.

The Tramways and Light Railways Association.

Annual Congress at Edinburgh.

A LARGE number of members of the Tramways & Light Railways Association were present on Thursday and Friday last week at the sixteenth annual congress, which was held in Edinburgh. The papers submitted in the course of the proceedings provoked discussions of technical and general interest, and led to a useful interchange of views. Mr. W. G. Verdon-Smith (Bristol), Chairman of Council, presided, and the organising duties were efficiently discharged by Mr. A. de Turckheim, secretary.

Most of the members arrived in Edinburgh on Wednesday, July 2nd, and the evening was devoted to an informal reception by Mr. R. S. Pilcher, general manager, Edinburgh Corporation Tramways, and Councillor Morris Mancor, Chairman of the Tramways Committee. Although most of the party had spent the day in travelling, a considerable number visited the Dunedin Rooms for dancing and a cabaret entertainment, which lasted into the small hours.

On Thursday morning a civic welcome was extended to the members and guests, including a large number of ladies, in the conference room at the North British Station Hotel, by Bailie M'Laren, Senior Magistrate of the Scottish Capital, who explained that Lord Provost Sir W. L. Sleigh was attending a conference of municipal authorities at Amsterdam, and was prevented from being at the opening of the congress, but would have an opportunity of meeting them later. They were delighted that the Association had chosen Edinburgh as the scene of this year's conference. This was most appropriate because they had just completed the transformation of their tramway system from being the most obsolete to, he hoped, the most up-to-date in the country. Cheap, rapid and safe transport was one of the greatest problems to-day, more especially in its relation to urban and suburban life, and the only way to solve these problems was by meeting and comparing their experiences.

After the reception the business of the annual general meeting was carried through. Subsequently Mr. R. S. Pilcher's paper was read and discussed, being followed by an informal luncheon. During the afternoon the members were taken for a long drive around Edinburgh, and through Stevenson's country to the Forth Bridge, returning to the Zoological Gardens for tea and the official photograph; they were entertained by the Tramways Pipe Band. The annual dinner took place that evening, the Lord Provost and members of the Corporation being guests, and another dance wound up a very enjoyable day.

On Friday, July 4th, papers by Messrs. W. E. Hardy and W. Nairn were presented and discussed; the Lord Provost and magistrates of the City Council gave a luncheon, and in the afternoon there was an excursion by motor coaches to the Scott country, Galashiels, Abbotsford, and Melrose, where tea was served; an informal dinner in Edinburgh ended the Congress, during which members had an opportunity of visiting the Edinburgh Corporation's Portobello generating station and the North British Rubber Co.'s works, while Mr. R. S. Pilcher arranged for motor coaches to drive the ladies through the city and outskirts, enabling them to visit Messrs. McVitie & Price's biscuit works, Edinburgh Castle, and Holyrood Palace.

Altogether it was a most successful conference, held in a beautiful city full of historical associations, and carried out with that complete thoroughness and great hospitality so characteristic of the Scottish people. Mr. Pilcher and Councillor Mancor deserve the highest praise for the excellence of the arrangements made for the entertainment of the visitors.

Annual General Meeting.

THE Chairman, in moving the adoption of the annual report, said the revenue derived from subscriptions amounted to £785, as compared with £761 for the preceding year, making with £31 interest, a total of £816. The expenditure was £762, as compared with £836, and, instead of a deficit of £43 as last year, they had a surplus of £54 in the net revenue, which brought their surplus assets up to £713.

It was gratifying to know that the cost to individual undertakings was so slight. That this was so was shown by the fact that the Association's revenue from subscriptions represented .013 of 1 per cent. of the gross revenue of company undertakings.

Perhaps the outstanding feature of the year had been the ever-increasing competition of motor omnibuses with tramways, emphasising the necessity for steps to be taken to relieve tramways from competition which was unfair because of the statutory obligations placed upon tramways. It was understood that the report of the Departmental Committee would be issued shortly, and they hoped that the Committee would have regard to the reasonable claims of tramway undertakings in connection with the licensing of motor omnibuses.

The unfair burden placed upon tramway undertakings in respect of road maintenance obligations had been greatly increased by the wear and tear brought about by the enormous increase in the speed and weight of motor traffic generally, and in many cases by competing motor omnibuses running over the tramways.

Last year they were endeavouring to get the Post Office to amend its regulations so as to ensure that private individuals erecting wires as aerials subsequent to the construction of tramways or light railways and in their vicinity should themselves be under the obligation to bear the cost of providing the necessary protection for the prevention of accidents. In this they were successful. The clause introduced in licences was only partially satisfactory. The Postmaster-General was not at present willing to go further in the direction they desired and therefore the owners of tramway overhead wires should take such precautions as they could to see that aerials in their vicinity were properly guarded and maintained.

This year they again called for reports from the various undertakings which were experimenting with the slipper type of collector. The Special Committee's report was approved by the Council and sent to the Ministry of Transport. It was to the effect that in some cases the slipper type had given fairly satisfactory results, probably due to the fact that there was centre-running. On the other hand, several undertakings which had side-running had had most unsatisfactory results and had, in consequence, abandoned the slipper altogether. Amongst the chief objections to this type was abnormal wear of the trolley wire and fittings, particularly on curves; possibly this wear might be cured or minimised by the adoption of a different metal for the shoe or by lubrication of the trolley wire, and therefore further experiments were being undertaken, but if the abnormal wear of the wire could not be cured this disadvantage would appear to offset the advantages which the slipper type might have.

The National Sliding Scale Agreement of September 28th, 1922, was in operation until August 16th next, that being the date of expiry of the notice given by the Unions to terminate the agreement. Besides giving that notice, the Unions were making application for a revision of the wages arrangements which would include the classification of tramway undertakings in four groups, in each of which standard rates would obtain. At the same time an increase of wages was being applied for. The matter was now before the National Joint Industrial Council, which had appointed a special wages committee to consider and report on it. The total reduction to date under the sliding scale agreement, since August, 1921, amounted to 15s. per week, leaving the bonus of 25s. The next adjustment, up or down, would be on August 1st next, based upon the cost of living index figure in July.

New Council.

The accounts and balance sheet were approved, and thanks were expressed to the six retiring members of Council:—Messrs. I. Bulfin, J. K. Bruce, W. V. Edwards, F. E. Gripper, R. J. Howley, and W. McGill.

The following were elected members of the Council:—Messrs. A. W. A. Chivers, Fred Coutts, W. E. Ireland, R. Stuart Pilcher, W. Tuke Robson, and C. R. Tattam.

The congress was thereafter formally constituted, and Mr. R. Stuart Pilcher submitted his paper, of which an abstract follows.

The Edinburgh Corporation Tramways.

By R. STUART PILCHER (*Abstract*).

THE importance of increasing the schedule speed of tramcars needs no demonstration. For this purpose the rate of acceleration should be as high as possible; air brakes will stop a car quickly with a saving of time, and the adoption of such service brakes is certainly a factor well worth taking into account. The use of low and convenient steps should receive special consideration. We use the smaller driving wheel, 26 in. in diameter, one of the advantages of which is a lower car and easier steps. The stairs of a car are one of the most important features in loading and unloading. We have restricted the height of the lower saloon to 6 ft. 3 in., and doing away with the usual 6 in. has enabled us to have risers of not more than 10 in. and a stair which one can mount with comfort and speed. The greatest advantage can be obtained by the use of an additional front entrance or exit, and, with centre entrance, double doors, the time at each stop can be practically halved, whether they are used simultaneously for entrance and exit or whether the front door is used for exit only.

The whole of the Edinburgh cars are fitted with front doors and folding steps on the near side, but we do not put them into regular use. We use them at busy stations for special events and for football matches. The ideal arrangement would be to use the front door for exit and retain the rear platform for entrance only, so that a stream of passengers would pass through the car in one direction, and the principle is made more attractive on a double-deck car by the possible use of a revolving staircase, as used on one of the cars on the Metropolitan Tramways in London. The obvious disadvantage of the use of a compulsory front exit is the zone system of fares which we have to contend with. There is nothing to prevent a passenger paying a penny fare and travelling beyond the stage, and it is necessary to overcome the draught question in order to make it a success. We have one car fitted up complete with pneumatic doors and steps.

Special brakes have been adopted in Edinburgh on the cars which have to negotiate heavy gradients. It is the ordinary standard magnetic track brake which we have fitted to all the cars, with the addition that the track shoes can also be applied to the rails by air. There is no attachment to the wheels. The usual practice is to use the air brake as a service brake, the magnetic brake being in reserve, either as an additional or an emergency brake. If both the air and current are applied simultaneously, it pulls up the car very quickly. When the air brake is used as a service brake it makes a gradual and easy stop. The drivers prefer it to the hand brake, as it requires no physical force to apply it, and makes skidding impossible. It does not easily get out of order, and is independent of the overhead line. The magnets are of the Metropolitan-Vickers type. We have also changed the design of the shoe, and its life has been doubled. The most important result, however, is the more even wearing of, and the reduction of wear on, the rail-head.

In Edinburgh track construction is as follows: We pack under the rail dry cement and chips two to one, and also on top of the concrete foundation and under the setts for a thickness of approximately 3 in. we use a packing of dry cement one, sand one, and chips one to one and one. The setts are laid in position, and then are grouted with pitch and bitumen as a waterproofing for ¾ in. The remainder of the grouting is wet cement and chips two to one, flooded to the top of the setts. The effect is to create a solid mass of concrete; the essential points are that the rails must be anchored at frequent intervals and bolted down on to the dry packing. Vehicular traffic is required to be kept off the paving for three or four days to permit it to set. "Jazzing," or "tail-wagging," on single-truck cars is a most important subject. The fitting of a double boss on the journal box of pendulum trucks will reduce the motion. My own view is that the single truck can be made so as to stop this motion.

The ventilation of cars should always be carefully considered, and I have been experimenting with the car motors for the purpose. We have coupled the ventilating apertures of the motors and connected tubes to the roof of the car, so that there is a constant positive ventilation, which operates in relation to the speed at which the car is travelling. The advantage of this system is that there are no draughts; there is nothing to get out of order; no moving parts, and no cost beyond fitting the tubes. I had intended to use the same system to heat the car in the winter, but our motors run practically cold.

Suggestion committees have been introduced in Edinburgh, consisting of representatives chosen by the men from each depôt or section of employés, and by the general manager, who is chairman. Other officials and foremen are sometimes called to the committees, but not as a rule. One of the chief objects of the committees as constituted is to get the rank and file of the employés into direct contact with the head of the department. While there are numerous suggestions from employés for the proposed improvement of their own conditions, there are also a great many, which are not promoted by self-interest, for improving the plant, the car services, &c. Members who are working at the time the committee meets attend the meetings without loss of time, but those who happen to be off duty are expected to attend without payment, and the minutes of each committee are immediately published in the depôts, so that all the employés know what is being done by the committee.

If suggestions are made which are considered of value, they are immediately carried into effect, as there is nothing more annoying to workmen than to see unnecessary delay in connection with their proposals. Suggestion books were tried, but were not appreciated.

Discussion.

Mr. A. W. A. CHIVERS (London) said those who knew the cable tramways would join in congratulating Mr. Pilcher and Edinburgh Corporation on the splendid way in which the transformation had taken place. Jazzing was a problem that they were all up against, and there seemed to be no one remedy for it. It had been eliminated at Middleton by ensuring an exact fit between the grooves and the check plates. Electric heating was a very important matter, especially in winter time, and particularly where they were suffering from motor-bus competition. If they could make their tramcars a little more comfortable it would be an excellent thing. He went into the question of electric heaters, and was astounded to find what the cost would be.

Mr. C. J. SPENCER (London) said: Mr. Pilcher mentioned in his paper the revolving staircase on one of their cars; that was to make the front exit on the near side of the car a possibility by the turning of the staircase at the terminus. They had not had sufficient experience as yet definitely to say whether they had got the last word or not, but the signs were favourable. The average speed was affected more by the shortness of the stops than by running the cars at an extremely high speed between the stopping-places. A few seconds saved per stop was worth a good deal of thought, and if they could get their cars so constructed that the passengers could leave at one end whilst others were pouring on at the rear, they would have done a good deal in that direction. Referring to the question of shunting current, Mr. Spencer said that in their case they had been able to speed up some old motors and improve the speed schedule to the extent of 7 to 10 per cent. That meant a lot of money on costs, and it had been done by automatic shunting of the fields. In the Metropolitan area a very high average speed was attained. Despite the density of traffic, speeds ranging from 9½ to 10 miles per hour were quite common, and on his own system they had quite a number of lengths of track where the average speed was 15 miles. He had never seen that touched in America—on urban systems, of course—or on the Continent. His people told him that the whole cause was the use of the magnetic brake for service purposes.

Mr. C. D. STANLEY (Gravesend) agreed as to the vital importance of the inclusive speed. A point which got less attention than it deserved was the number of the stops. It was amazing to find out the effect on their inclusive speed of having additional stops.

Mr. H. J. TROUGHTON (London) uttered a warning against using the ordinary resistances which they had in the motor circuit for heating cars. It was tried on their system many years ago. The resistances were under the seats, and one-third of the seating accommodation could not be sat on.

Mr. H. BOND (Birmingham) said that after some ten years' experience he considered the air brake was far and away the best tramway brake they could get. It was free from the nasty shocks they got with the magnetic brake. Speed on tramways was a very important factor. If they were going to hold their own against the motor-bus they must increase the speed. Air brakes saved an immense amount of time actually in the running. They could run the car at a higher speed and have more safety than with the hand-operated brake.

Mr. R. B. HOLT (London) said the question of jazzing began to get on everybody's nerves. There did not appear to be a definite cure for it. As a matter of fact, they were seeking cures when they ought to be looking for the cause. It was surprising to him they had so little jazzing. Take the case of the standard section. He was always up against standard sections because he did not believe in the standardisation of things like that. Conditions on every system were individual, and he did not think their representatives on the Standardisation Committee had got what they were after. The tire specification gave them a point contact, but the wheel treads and rail treads should coincide.

Mr. E. H. EDWARDS (Atherton) did not like the suggestion with reference to seats for drivers. If they had the ordinary brakes the driver must stand, so, in addition to seats, they would have to re-brake their cars.

Mr. H. ENGLAND (Wakefield) said they had grown up from the horse-car days, and instead of decreasing the number of stopping-places and treating tramways like a railway, owing to local considerations and the desire to please everybody they had tried to put a stop at everybody's front door. That was absolutely the wrong way.

Mr. A. NORTON (Sheffield) said that suggestions had been put forward with regard to the welding of axles. There might be danger in doing that, because they would have a different temper in the two portions, and there might be considerable risk of the axle not wearing satisfactorily after that had been done. With regard to the grooving of the tires which had been suggested, there was very great danger there unless the groove was put in with a round-nosed tool.

(To be concluded.)

Some of the Exhibits at Wembley.

Messrs. Everett, Edgcumbe & Co., Ltd.

(*Stand No.* 90, *Avenue* 13, *Bays* 6 *and* 7.)

Messrs. Everett, Edgcumbe & Co., Ltd., who have for the last quarter of a century specialised in the manufacture of industrial electrical measuring and controlling instruments, have a large and extremely interesting exhibit covering the complete range.

A number of protective relays, shown in actual operation on a miniature transmission system, form a conspicuous feature. Various methods of protection, such as overcurrent and leakage, instantaneous and time lag, balanced voltage, both with and without compensation for capacity, differential and directional, are included.

Fig. 133.—An "Everett Edgcumbe" Portable a.c. Testing Set.

The "Superscale" instruments introduced by the firm are much in evidence. Two instruments placed in juxtaposition show the great advance which has been made, both having the same external dimensions, but an enormous difference in scale length. Besides switchboard and portable, moving-iron and moving-coil ammeters and voltmeters, "Superscale" wattmeters are now available for single-phase and three-phase measurements, with either balanced or unbalanced loads.

A very convenient and portable alternating-current testing set is being shown (fig. 133). It consists of two instruments, side by side, one a wattmeter and the other a combined ammeter and voltmeter of the "Universal" moving-iron pattern. To change over from a voltage to a current measurement, it is only necessary to depress the appropriate knob, which disconnects the instrument winding from the voltmeter terminals and connects it to the secondary of a small self-contained current transformer, through the primary of which the current to be measured is passed. The standard set has voltmeter and wattmeter ranges of 150, 300, and 600 volts, and a self-contained current range up to 6 amperes. The omni-range current transformer, which was described in our issue of February 2nd, 1913 (p. 197), affords a convenient means of extending the range of current, even up to thousands of amperes.

To the Everett, Edgcumbe "Inkwell" recording instruments there have been added the "Inkwell" graphic power-factor meters, which have been extensively used by power-station engineers for the purpose of checking the consumer's power factor, with a view to introducing some means of improving it. In some systems it is the average power factor over a period which is required, and for this purpose a special planimeter has been developed, by means of which the average can be determined by a single operation. This planimeter is shown in fig. 134.

The firm has recently developed a recording equipment for use on electric trains. The standard equipment, as shown in fig. 135, affords continuous records of volts, amperes, and speed in miles per hour throughout the run. The graphers operate on the relay principle, which has proved to be the only successful one under the extremely trying conditions of vibration, &c., which are met with in railway working. A small motor, which runs at a constant speed, drives forward the charts in synchronism with one another, and also provides the necessary power for moving the recording pens across the chart in response to the deflections of electrical movements, which indicate the values of the respective quantities. As the charts have rectangular co-ordinates, it is possible accurately to measure and compare the values of each quantity at any given instant.

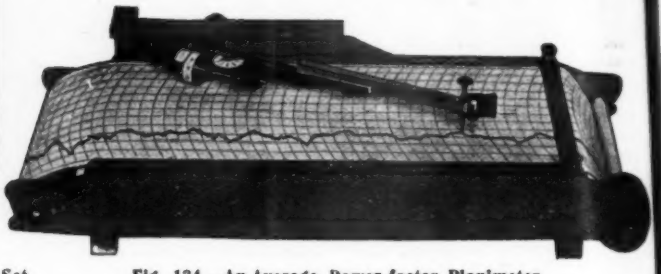


Fig. 134.—An Average Power-factor Planimeter.

Fig. 136 shows the firm's extra-high-pressure electrostatic voltmeter, which has now been standardised to 300 kilovolts. The readings are unaffected by frequency, and are equally accurate whether one pole is earthed or not. The insulators are of porcelain, and are most liberally designed; they are immune from troubles due to extreme high frequencies. A "dwarf" electrostatic voltmeter, reading up to 3,000 volts, is also shown, which has a dial diameter of only 3½ in. This is the smallest instrument of this class which has so far been produced.

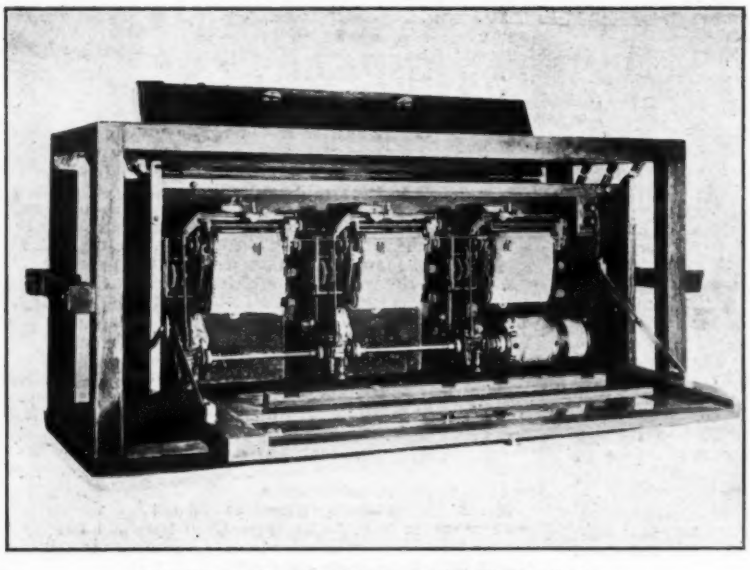


Fig. 135.—A Recording Equipment for Electric Trains.

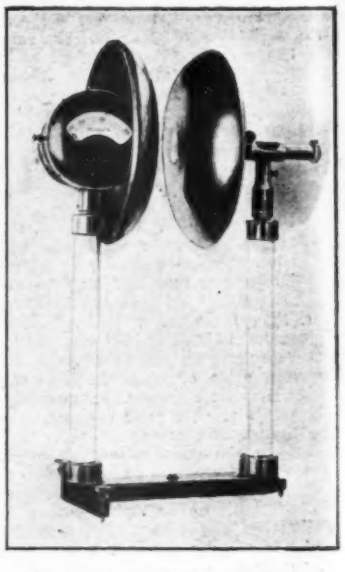


Fig. 136.—An "Everett Edgcumbe" Electrostatic Voltmeter.

Messrs. Everett, Edgcumbe & Co. have carried out a very large amount of research work at radio frequencies, and have developed a line of thermal ammeters, both direct acting and transformer-connected, for currents up to 500 amperes or more at frequencies ranging up to 1,000,000 cycles per second.

To meet the requirements of the "listener-in," a range of "dwarf" instruments has been developed. For the direct measurement of mean spherical candle-power at a single measurement, Messrs. Everett, Edgcumbe & Co. are showing the cube photometer. Another pattern has been developed which is entirely self-contained, so that a dark room is unnecessary, and the arrangement is such that the scale is direct reading in either mean spherical candle-power or lumens as preferred.

Another exhibit is the phase-rotation indicator illustrated in fig. 137. This is a small instrument fitted with three flexible leads, coloured red, yellow, and blue, respectively, terminating in spring clips. These can be connected to any convenient "live" points, and if the sequence of phases is in the order

Fig. 137.—An Everett Edgcumbe Phase-rotation Indicator.

red, yellow, blue, the disk of the instrument will rotate in the direction of the arrow. If, on the other hand, the sequence is incorrect the disk will rotate in the opposite direction.

Messrs. J. & E. Hall, Ltd.

(*Stand No.* 27, *Avenues* 6 *and* 7, *Bays* 14 *and* 15.)

This company is showing a selection of types and sizes of refrigerating machines for marine and land installations on both the CO_2 and NH_3 systems, varying in rating from 70 tons ice-melting to ¼-ton electrically-driven plants, including large sizes for use in ships driven by oil engines, and special attention has also been devoted to high speed NH_3 machines for land installations suitable for direct coupling to electric motors.

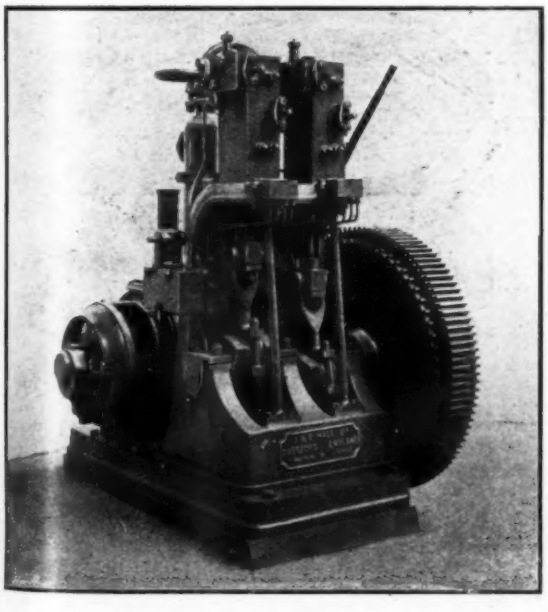


Fig. 138.—A Twin-compressor Vertical Marine Type CO Machine.

Many of the latter designs are also suitable for marine installations.

The company undertakes the manufacture of coil work in steel, iron, or copper pipes for high- or low-pressure work, and examples are exhibited on its stand, the railings of which are formed of galvanised "grids" as used for cooling insulated chambers.

The exhibits include the following:—A large horizontal tandem steam-driven CO_2 machine as used in pairs on the largest frozen and chilled meat ships, two such machines having a combined rating of 140 tons refrigeration. A high-speed vertical enclosed NH_3 machine of 70 tons capacity: this machine is specially designed for direct coupling to an electric motor and is suitable for all descriptions of cold storage work, ice-making, and many other uses. A twin-compressor vertical marine-type CO_2 machine for electric drive (g. 138): capacity 12 tons ice-melting. Suitable for dealing with large provision chambers or, alternatively, with an insulated cargo hold or 'tween deck space. A steam-driven vertical marine-type CO_2 machine complete with brine and water pumps. A small enclosed vertical NH_3 machine suitable for small provision chambers on board ship or for small cold storage installations on land, such as butchers' shops or dairies: capacity, 2 tons ice-melting. A high-speed NH_3 machine, direct coupled to an

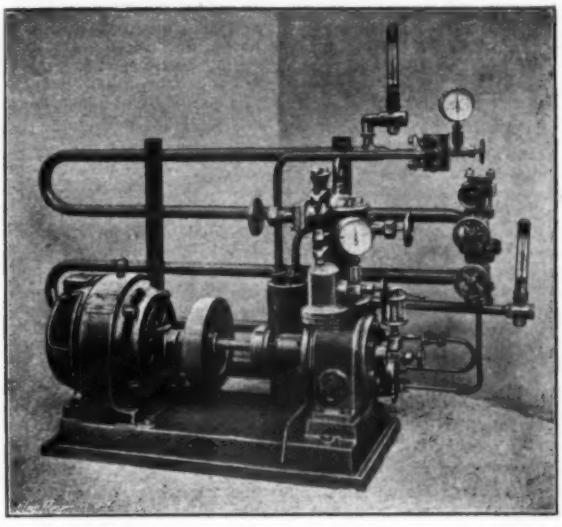


Fig. 139.—A High-speed NH_3 Refrigerating Machine.

electric motor (fig. 139), specially designed to meet the large demand for a reliable refrigerating machine on a small scale. This is suitable for butchers, fishmongers, dairies, and domestic purposes, more especially where the space available for the plant is too limited for a belt drive, and substantial economy in running costs and results is obtained.

The W. A. L. Coal Cutter, Ltd.

(*Stand No.* 120, *Avenue* 4, *Bay* 28.)

This firm exhibits two examples of its coal-cutting machines, one of the chain type and the other of the disk pattern.

The former (fig. 140) is fitted with a totally-enclosed 25-b.h.p. motor—two-hour rating. In the a.c. type the motor is of the squirrel-cage construction designed to give large starting and overload torques. The stator yoke is in two halves, parted along the horizontal diameter, and the complete stator is let into the yoke and secured by large vertical bolts; the end covers, with the bearing housings, complete the structure. This construction allows a joint face of over 2-in. width at the ends, and so does away with the usual spigot joints, which are very restricted. It is stated that it is practically impossible for water to get into the interior of the case. The d.c. motors are fitted with inter-poles which ensure sparkless

Fig. 140.—The "W.A.L." Chain Type Coal-Cutter.

running at all loads within the capacity of the motor. Both types of motors are flameproof. The starting switches are of the contactor type; each contactor is cam operated and has a very efficient magnetic blow-out. The blow-out circuit has been specially designed for the duty, and it is possible to "inch" the cutter chain round by the motor without injury to the switch. The whole switch is built on the steel and mica principle, and is of very substantial construction. The resistances are made from a special nickel-chrome alloy, and are pressed up tight with mica plate separators.

In the disk machine the motors, both a.c. and d.c., are totally enclosed and are of 33 b.h.p. two-hour rating. The a.c. motors have wound rotors, but otherwise the general construction is the same as in the chain machine. The d.c. motor is fitted with inter-poles, as in the chain type, and the starting switches and resistances are also of the same pattern. The whole electrical equipment of these machines is said to comply in detail with the latest Home Office requirements for the use of electricity in mines.

Messrs. Galloways, Ltd.

(*Stand No.* 81, *Avenues* 11 *and* 12, *Bays* 24 *and* 25.)

The principal exhibit of this company is a "Uniflow" steam engine in motion (fig. 141). In this the steam is admitted at the ends of the cylinder and is exhausted through a series of ports arranged in the centre of the cylinder barrel. The exhaust ports are uncovered by the piston when it reaches about 90 per cent. of the working stroke, and closed again at about 10 per cent. of the return or compression stroke. This system results in high thermal efficiency since the steam ports and cylinder walls adjacent to them are not subjected to the violent cooling action of exhaust steam rushing past them, while the exhaust ports are not exposed to live steam. In this manner cyclical fluctuations of temperature in the cylinder walls are greatly reduced.

The engine exhibited has a cylinder 25 in. in diameter, with a stroke of 2 ft. 6 in. The normal economical output when working with steam at 160 lb. per sq. in. and running condensing, is 500 i.h.p. Owing to lack of water, the engine is running non-condensing. The engine is equipped with a rope-driving wheel, 11 ft. in diameter, grooved for 14 ropes of 1¼ in. diameter. The "Galloway" patent oil valve gear, by which the steam valves are operated, is a remarkable and simple piece of mechanism. In this gear oil under pressure is applied below the plunger connected to the valve spindle and lifts the valve, which seats itself again by the action of a spring and dashpot when the fluid pressure is released. An eccentric on the lay shaft operates the ram of an oil pump arranged in the valve bonnet. The pump ram is hollow, and has a ring of slots or ports, which at certain parts of the travel may be covered by a sleeve surrounding the pump ram, the axial position of this sleeve being controlled by the governor. On the up-stroke of the pump, oil is forced, by the ram, into the pressure chamber below the plunger, thus raising the plunger and the steam valve. At a point determined by the position of the governor, the ports in the hollow pump ram over-run the sleeve, and the oil escapes through the ports back into an oil reservoir. The steam valve is now free to close under the combined action of the spring and the dashpot piston, the seating of the valve being both rapidly and quietly performed.

Another important feature is the automatic safety compression release gear fitted. The principle of operation of this gear is similar to that of the steam inlet valve gear, the sleeve

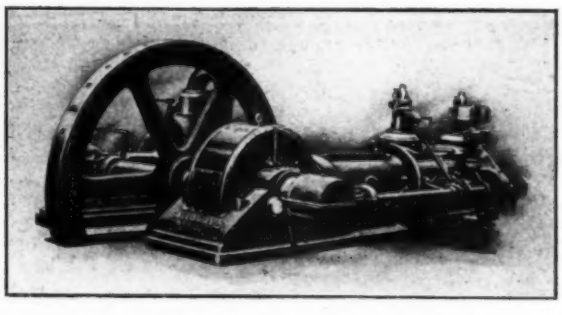


Fig. 141.—A "Galloway" Uniflow Steam Engine.

valve on the pump ram being under the control of a small cylinder, one side of which is connected to the condenser, the other to the atmosphere. Under normal conditions of vacuum the supplementary exhaust valves remain seated and out of action, but if the pressure in the condenser rises, the piston in the vacuum cylinder moves the sleeve valve so that the supplementary exhaust valves are allowed to open during a portion of the compression stroke. A mechanically-operated positive sight feed lubricator is used for the cylinder lubrication. The central forced lubrication system which serves the main bearings, crank pin, and crosshead pin is arranged for oil cooling. The steam consumption of the "Uniflow" engine is very low, and compares favourably with that of compound or triple expansion engines. The overload capacity compared with the standard normal rating is much greater than with compound engines, and at the same time the engines have greater simplicity and lower upkeep expenses. Therefore they are eminently suitable for the driving of factories, e'ectric generators, large centrifugal pumps, and other duties calling for speeds of rotation up to 200 r.p.m. Other exhibits are a multiple-flow superheater; boilers and fittings; tubes, manholes and standpipes; and electrodes for arc welding.

Messrs. Nalder Bros. & Thompson, Ltd.

(*Stand No.* 6, *Avenues* 8 *and* 9, *Bays* 20-24.)

This firm has a comprehensive collection of electrical measuring instruments. Among these is the "Ideal" type "N.C.S." ammeter of the moving-iron pattern designed for use in positions where heavy overloads are experienced. It is arranged to indicate up to 100 per cent. overload. A power-factor meter, which is among the exhibits, is illustrated in fig. 142. This has a 360 deg. scale, and having no ligaments or moving coils, indicates accurately on low loads. The indications are independent of variations of current, pressure, temperature, frequency, and wave form. A three-phase voltmeter

Fig. 142.—Nalder Bros. & Thompson Power-factor Meter.

is shown which is intended for use with three-phase instrument transformers. It gives instant indication of incorrect phase rotation, faulty connection, or blown fuses. Another type of instrument exhibited is a rotary synchroscope. No moving coils are employed, and all troubles due to slip rings, &c., are removed. It is self-contained for pressures up to 650 V. The instruments shown have dials of 8 in., 12 in., and 20 in. diameter respectively. An advance upon this design consists of a synchroscope with a red, green and white signalling device. The red light shows that the incoming machine is totally out of phase with those on the bus-bars; the green

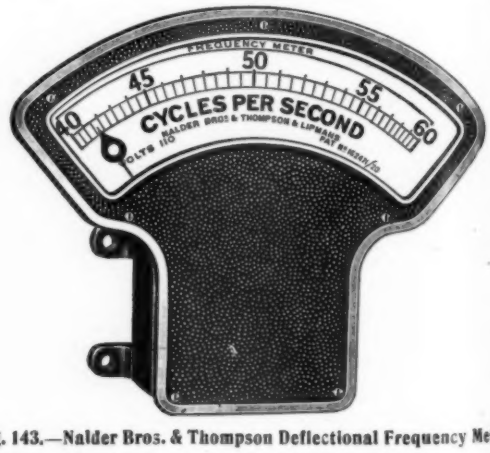


Fig. 143.—Nalder Bros. & Thompson Deflectional Frequency Meter.

light indicates that synchronism is being approached; and the white light appears when that stage is reached. The deflectional frequency meter illustrated in fig. 143 is a further exhibit. This gives readings, which are independent of temperature errors, over a long and open scale. The instrument depicted has an illuminated dial, and is of the sector pattern, but other forms are also shown. In addition to the meters, the firm also displays protective relays of various patterns, including the "Fawssett-Parry," reverse power, overload, induction overload, time-limit overload and other relays. Other exhibits are sub-standard instruments, recording instruments, leakage recorders, testing sets, &c.

The Power Plant Co., Ltd.

(*Stand No.* 11, *Avenues* 8 *and* 9, *Bays* 25 *and* 26.)

Machine cut double helical gears of many types and sizes form the bulk of this company's exhibit. In addition, a number of flexible couplings are shown. These include the company's "L" type coupling which is composed of a series of leather rings; this is suitable for use with steady loads. For situations in which heavy overloads and shocks are encountered the firm has a special compression type coupling.

Electrically-Driven Ships' Auxiliaries.

The New Austin System.

THE application of the electric motor drive to ships' auxiliary plant has been difficult in that it has not equalled the steam drive in the two following important respects—namely: (*a*) It cannot, efficiently, maintain full strain on a stationary rope or anchor chain for long periods, and (*b*) it is peculiarly subject to stoppages, by the blowing of fuses, often at a critical moment. Nevertheless, the advent of the Diesel engine-driven vessel has made the electric drive a matter of urgency, and its economy is undoubted. A paper read before the Institution of Engineers and Shipbuilders in Scotland, showed that much less fuel was required when electrical auxiliaries were installed on a Diesel-engined ship, as compared with the same ship fitted with steam auxiliaries, and that that saving represented approximately £2,000 in the case of a 2,000-ton vessel during a normal working year.

It is therefore satisfactory to know that Messrs. Gilbert Austin, Ltd., of Cathcart, Glasgow, have developed a new system which is claimed to entirely overcome the above-mentioned defects, combining not only the best characteristics of the steam engine with the advantages and economy of the electric motor, but also having an efficiency hitherto unattainable. The special features of the arrangement, all of which the makers are prepared to substantiate, are as follows:—Overloading is impossible; fuses and large power-absorbing resistances are abolished; controllers are modified and simplified; motors cannot be burned out by excess current; full-tension, or any desired less pull can be maintained on a winch rope for any period with the motor armature at a standstill; in cranes and winches, power generated by descending loads is returned to the line to assist in raising other loads; pumps can operate automatically on a closed pipe system, without special electric control gear; and motors have no fine windings and the insulation is indestructible.

As yet the patentees are not in a position to publish technical details, but the fact that the system has reached the commercial stage was clearly shown at a recent demonstration, as briefly reported on p. 1052 of our June 27th issue, which aroused keen interest. It is hardly necessary to point out that the very characteristics which make usual constant-pressure systems advantageous for steady speed work, render it naturally unsuitable for many applications on board ship; the motor cannot be directly connected to the machine which it has to drive without the use of complicated, bulky, and expensive switchgear and a large amount of cabling. Invariably a difficulty arises when full-load torque is needed at speeds below the normal, for which a given motor is designed, involving voltage reduction by wasteful means and the provision of overload protection devices which may rupture the circuit at an inopportune moment.

The Austin method reverses the present order of things, simplifies matters by dispensing with the usual accessories, and attacks the problem at the generator. The system is a series constant-current one that allows the voltage to vary in harmony with the speed, but obviates the need for an automatic brush adjuster. The generators have fixed brushes, no moving parts whatever being necessary, except the revolving armatures of the dynamo and its exciter, and we understand that motors have been produced on similar lines suitable for driving any kind of machine, and capable of any variation in speed in either direction from zero up to as much as twice normal full load speed, with high efficiency at all speeds—a great step in advance.

The prime mover may be any convenient steam, Diesel, or semi-Diesel engine, turbine, or an electric motor supplied from any existing system. It is coupled direct to the constant-current dynamo, and the exciter, a small special machine, is carried on an extension of the bedplate and driven by a flexible coupling from the dynamo shaft. The instruments and switches are of the simplest kind, an ammeter and voltmeter for each dynamo; a main switch for each dynamo, arranged according to the scheme of cable ring mains; and a small field regulator for the exciter, to enable the line current to be adjusted by hand to any desired value, and, in case the line should accidentally be broken, an automatic circuit maker is provided to short-circuit the generator, under open circuit conditions, and thereby maintain the current constant. This is done for the protection of the exciter and field magnet winding of the generator, and to extinguish any arc which might be formed at the break in the line.

In its simplest form the cable system is a single cable arranged in a series circuit from motor to motor, the first and last motors being connected to the generator as shown in fig. 2, which shows an arrangement to give 250 amps. for deck machinery and 500 amps. for large motors in the engine room.

The amounts of cabling necessary to supply deck auxiliaries on the usual and Austin systems are clearly compared in fig. 1. In view of the fact that a breakdown of insulation at two or more places is the only fault that could affect the continuous operation of the system, and that only partially, special attention is given to the cable; if metal sheathed, it is designed for a working pressure at least double that of the total voltage of the system, and with reasonable care an insulation breakdown should be a very remote possibility, while the flow and return cables are in all cases led side by side to neutralise magnetic effect.

The motors are simple, robust machines, built on standard lines, having interpoles and fixed brushes, as shown in fig. 3. The armature carries the main line current, and the field circuit is connected to a variable potentiometer on the main line, which contains the only resistance used, and consists of two short lengths of alloy of large section; it is run at a low temperature, and the energy used in the potentiometer and field windings together is not more than that used in the field windings alone of an ordinary motor.

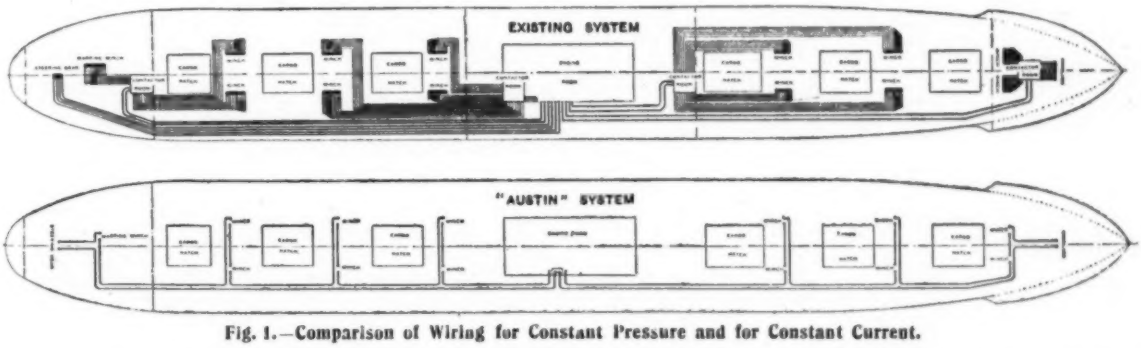


Fig. 1.—Comparison of Wiring for Constant Pressure and for Constant Current.

A small motor is formed on the end cover carrying the shaft bearing, and is so interconnected with the main motor that the small motor operates automatically to adjust the magneto-motive-force of the main motor field magnet. Speed control, in either direction, is obtained by moving the contact arm of the potentiometer regulator from zero to any suitable position one way or the other. The small machine operates up to about 3 or 4 volts, and assists the main motor either in producing torque, or in regenerating energy in harmony with the main motor, which, including the small regulating machine, has conductors of large section, and is insulated with mica or micanite and thoroughly impregnated. Cotton or combustible material of any kind is avoided wherever possible.

The regulating-machine windings are proportioned according to the purpose for which the motor is to be used, so as to give speed-torque characteristics similar to a series-, shunt-, or compound-wound motor operating on the parallel system, as may be desired, but always with the great difference that an overload at any speed slows the motor down and, at speeds below normal, full torque is maintained (and even increased) as the speed approaches zero. Each motor is provided with a d.p. two-way main switch interlocked with the commutator inspection doors; in one position the switch connects the motor to the line, while in the other the motor is disconnected and the line "shorted," the movement being effected without rupture of the main circuit. In addition, a two-way short-circuiting and disconnecting switch is connected to the control lever so that when the regulator is at neutral the motor is "dead," and when the regulator is at any other position the motor is "live" and in series with the line.

The exceptional qualities of the motors will best be appreciated by reference to the performance for which they are specially suitable. For instance, of all the machines which an electric motor is called upon to drive, the winch is perhaps the most exacting. With the new machine the foot brake

may be applied at any time and the motor brought to rest, while power is full on, without damage to the motor or speed regulator. The speed is under the control of the operator, but is, in addition, automatically limited to correspond with the weight being lifted, lighter loads being moved at higher speeds than heavy loads. The motor will maintain full tension on the rope for any length of time with the armature at a standstill, and will take up slack automatically, while the load can be held in mid-air without the use of any brake. Table I compares its performance under such circumstances with that of a motor of the same output operated on a 220-volt constant-pressure circuit.

TABLE I.

	Constant Voltage.	Constant Current.
Motor current	125	250
Motor terminal voltage ...	10	5
Voltage across terminals of resistance	210	Nil
Power used by motor	1.25 kW	1.25 kW
Power wasted in resistance ...	26.25 kW	Nil

When the motor is running at full speed, full power, there is no difference in efficiency between equal apparatus on the two systems, but the constant current machine is superior in that it cannot be overloaded, while, in lowering, the speed control is flexible and 40 per cent. of the energy produced by the falling load is returned to the line.

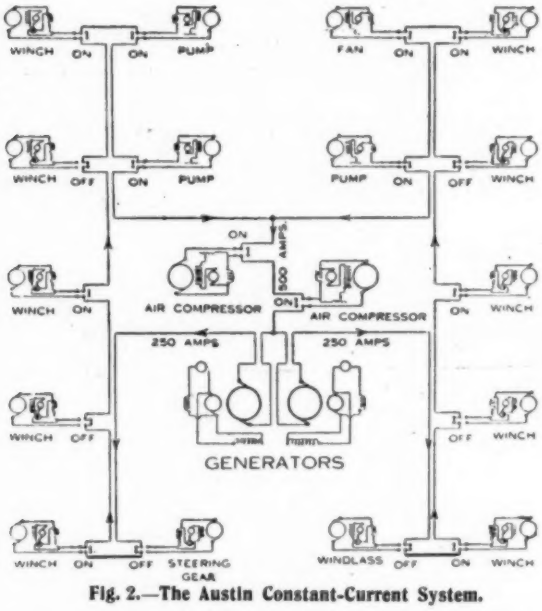


Fig. 2.—The Austin Constant-Current System.

The characteristics for the windlass are similar to those for the winch. Regeneration does not apply in this case, as the anchor is dropped on free barrel, but the all-important feature is that the full-load strain can be maintained as long as necessary with no waste of power, and no danger of stoppage through the rupture of a fuse. If operating a pump, the Austin motor will adjust its speed to the volume of water or air encountered, and when starting a ram pump under full head unloading arrangements have not to be adopted, while it is particularly useful for maintaining a constant pressure in any closed pipe system such as a sanitary supply or wash deck service; when the fluid pressure in the discharge corresponds with the torque, the motor stops (due to overload), but creeps round to compensate for any leakage, and revolves in accordance with the rate at which the fluid may be drawn off. For driving cranes, fans, and steering gear the constant-current machine possesses the correct characteristics, while a further use for constant current is for heating and cooking. For heating cabins the apparatus is of the simplest description, and either low temperature convection, or radiant heat, can be adopted at will, without the introduction of hot-water radiators in the former case. In the case of radiant fires the elements are stout rods or strips of nickel-chrome, and in a 250-ampere circuit the voltages are: 1 kW, 4 volts; 2 kW, 8 volts; 3 kW, 12 volts. For cooking ranges, grillers, &c., the heating elements are stout rods or strips, as in the case of radiant fires. Heat regulation is obtained by diverting; fine ranges of temperature are easily effected, and the control apparatus is simple and robust. The abolition of all fine wire spirals is a distinct attraction.

For sets above 150 kW working up to 600 volts two generators are coupled to one prime mover so as to provide two independent ring mains of 250 amperes each, combining on the return circuit in one cable carrying 500 amperes, which can be used for large motors in the engine-room.

Tests of the new system have produced remarkable results, and the Austin method should certainly have a wide field of application, and will probably become a serious rival of steam-driven ships' auxiliary plant. In conclusion, it should be mentioned that the generators, exciters, motors, switchgear, &c., will be manufactured at Cathcart under the Austin-Macfarlane patents.

London County Council Tramways.

Committee's Report for 1923-24.

THE Highways Committee of the London County Council reports that the total income of the tramways for the year ended March 31st last was £4,374,057; this compares with a total of £4,909,891 in 1922-23. The working expenses also declined, being £3,518,362 as against £4,038,028. The surplus on working was thus £855,695, but from this was deducted £310,241 for renewals, leaving a surplus on revenue account of £545,454; in the previous year there was a gross surplus of £871,863. The capital charges, income tax, &c., were £64,064 higher at £705,676,

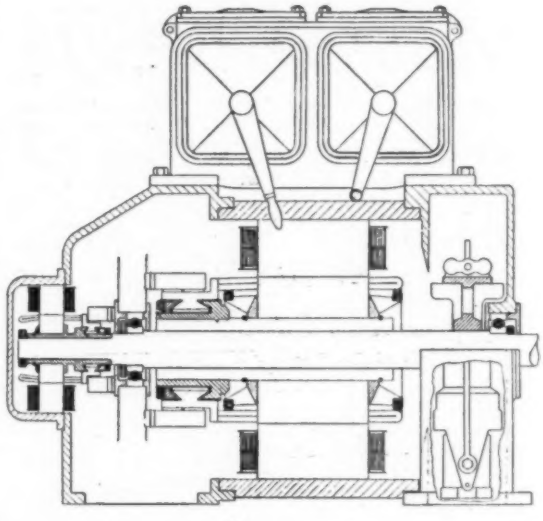


Fig. 3.—Sectional Diagram of the Austin Motor.

and the result was therefore a deficit of £160,220, comparing very unfavourably with a net profit of £230,251. A contributory cause of this deficit was the suspension of services during the recent strike (March 22nd-31st); the reduction in expenditure due to this only partly counter-balanced the loss of revenue. The deficiency has been met out of the reserve fund to which the bulk of last year's profit was transferred, leaving £40,605 in the fund.

The total number of passengers carried during the year was 689,015,086, and the number of car-miles run was 64,118,595; in the preceding year the equivalent figures were 733,811,367 and 63,381,367. The average receipts per car-mile fell from 18.13d. to 16.04d., while the working expenses (excluding capital charges and renewals) declined from 13.85d. to 13.17d. per car-mile.

The capital expenditure on the undertaking was increased during the year by £171,421, bringing the total up to £16,255,814. The net outstanding debt at March 31st last was £8,848,583. The amount set aside for debt redemption in respect of the past year was £399,136—the highest contribution since 1919-20 when the cumulative annuity system of repayment was adopted.

The total sum paid to metropolitan borough councils and the City Corporation as rates on the permanent way amounted in the year under review to £61,405; this was additional to rates paid in respect of offices, car sheds, sub-stations, depôts, &c. The saving to the road authorities in consequence of the obligation of the Council to maintain the paving along the tramway routes is estimated to be about £255,000 a year on the present mileage, and under a normal standard of maintenance. The undertaking's contribution to the cost of street improvements is put at £793,027, of which £747,745 had already been charged at March 31st last.

The total length of the Council's lines at the end of the year was 164.14 miles, being 122.53 miles of conduit and 41.61 miles of overhead lines. Two new lines were opened to traffic during the year, namely, those between Tower Bridge Road and Tooley Street, and between Stamford Hill and Seven Sisters Road, *via* Amhurst Park.

Trade Statistics of South Africa.

THE following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1923, has been compiled from the recently-issued official trade statistics. The figures for 1922 are added for purposes of comparison, and notes of any increases or decreases are made:—

	1922.	1923.	Inc. or Dec.
Electrical cable and wire.—	£	£	£
Total	198,000	360,000	+162,000
From Great Britain	186,000	344,000	+158,000
„ United States	4,000	4,000	—
„ Germany	6,000	8,000	+ 2,000
„ Belgium	1,000	2,000	+ 1,000
Batteries, primary.—			
Total	11,000	24,000	+ 13,000
From Great Britain	2,500	5,000	+ 2,500
„ United States	5,500	14,000	+ 8,500
„ Sweden	1,000	1,000	—
„ Denmark	—	2,000	+ 2,000
Batteries, secondary.—			
Total	22,000	50,000	+ 28,000
From Great Britain	11,000	19,000	+ 8,000
„ United States	10,000	24,000	+ 14,000
Heating and cooking apparatus.—			
Total	24,000	30,000	+ 6,000
From Great Britain	13,500	17,000	+ 3,500
„ United States	6,000	7,000	+ 1,000
„ Germany	5,000	5,000	—
Insulators, porcelain.—			
Total	8,000	6,000	− 2,000
From Great Britain	6,000	3,000	− 3,000
„ United States	—	1,000	+ 1,000
„ Germany	1,000	2,000	+ 1,000
Insulators, all other.—			
Total	2,000	3,000	+ 1,000
From Great Britain	1,000	2,000	+ 1,000
Lamps, incandescent.—			
Total	90,000	112,000	+ 22,000
From Great Britain	41,000	49,000	+ 8,000
„ Holland	18,000	20,000	+ 2,000
„ United States	19,000	18,000	− 1,000
„ Germany	7,000	10,000	+ 3,000
„ Austria	2,000	9,000	+ 7,000
„ Hungary	1,000	3,000	+ 2,000
Motors.— Total	87,000	225,000	+138,000
From Great Britain	45,000	122,000	+ 77,000
„ United States	24,000	55,000	+ 31,000
„ Germany	7,000	27,000	+ 20,000
„ Holland	3,000	8,000	+ 5,000
„ Sweden	3,000	11,000	+ 8,000
Transformers.—			
Total	19,000	48,000	+ 29,000
From Great Britain	12,000	36,000	+ 24,000
„ United States	5,000	8,000	+ 3,000
„ Germany	1,000	2,000	+ 1,000
Electrical machinery, other.—			
Total	204,000	169,000	− 35,000
From Great Britain	163,000	121,000	− 42,000
„ United States	16,000	23,000	+ 7,000
„ Germany	14,000	17,000	+ 3,000
„ Sweden	8,000	2,000	− 6,000
Electrical material, other.—			
Total	314,000	428,000	+114,000
From Great Britain	199,000	258,000	+ 59,000
„ United States	48,000	77,000	+ 29,000
„ Japan	—	500	+ 500
„ Holland	5,000	3,000	− 2,000
„ Germany	50,000	66,000	+ 16,000
„ Switzerland	2,000	4,000	+ 2,000
„ Czecho-Slovakia	2,000	6,000	+ 4,000
Cranes.— Total	30,000	25,000	− 5,000
From Great Britain	23,000	23,000	—
„ United States	—	1,000	+ 1,000
„ Germany	5,000	—	− 5,000
Elevators and lifts.—			
Total	21,000	17,000	− 4,000
From Great Britain	19,000	16,000	− 3,000
„ United States	2,000	—	− 2,000
„ Italy	—	1,000	+ 1,000
Mining machinery.—			
Total	553,000	734,000	+181,000
From Great Britain	351,000	407,000	+ 56,000
„ Sweden	11,000	14,000	+ 3,000
„ United States	154,000	270,000	+116,000
„ Germany	30,000	31,000	+ 1,000
„ Belgium	3,000	3,000	—
„ Holland	—	4,000	+ 4,000
Telegraph and telephone material.—			
Total	30,000	30,000	—
From Great Britain	19,000	20,000	+ 1,000
„ Sweden	1,000	1,000	—
„ United States	1,000	5,000	+ 4,000
„ Czecho-Slovakia	5,000	1,000	− 4,000
„ Belgium	2,000	3,000	+ 1,000
Wireless apparatus and parts.—	*	29,000	*
Total	*	26,000	*
From Great Britain	*	3,000	*
„ United States			
Tramway rails.—			
Total	11,000	22,000	+ 11,000
From Great Britain	10,000	16,000	+ 6,000
„ United States	1,000	6,000	+ 5,000
Tramway rolling-stock.—			
Total	32,000	24,000	− 8,000
From Great Britain	28,000	12,000	− 16,000
„ United States	3,000	12,000	+ 9,000
Other tramway materials.—			
Total	28,000	23,000	− 5,000
From Great Britain	24,000	17,000	− 7,000
„ United States	2,000	5,000	+ 3,000
Pumps.—			
Total	82,000	87,000	+ 5,000
From Great Britain	51,000	50,000	− 1,000
„ United States	12,000	24,000	+ 12,000
„ Switzerland	13,000	6,000	− 7,000
„ Germany	3,000	5,000	+ 2,000
Engines, oil, petrol and spirit.—			
Total	38,000	40,000	+ 2,000
From Great Britain	32,000	30,000	− 2,000
„ United States	3,000	5,000	+ 2,000
„ Germany	1,500	2,000	+ 500
„ Sweden	1,000	1,500	+ 500
Engines, other.—			
Total	84,000	134,000	+ 50,000
From Great Britain	70,000	126,000	+ 56,000
„ United States	1,000	2,000	+ 1,000
„ Germany	4,000	5,000	+ 1,000
Leather driving belts.—			
Total	42,000	41,000	− 1,000
From Great Britain	19,000	21,000	+ 2,000
„ France	1,000	3,000	+ 2,000
„ United States	19,000	16,000	− 3,000
Other driving belts.—			
Total	90,000	120,000	+ 30,000
From Great Britain	56,000	67,000	+ 11,000
„ Canada	4,000	13,000	+ 9,000
„ United States	28,000	38,000	+ 10,000

In addition to the above the following goods were imported as "Government stores":—

Batteries, primary.—			
Total	1,000	4,000	+ 3,000
From Great Britain	100	2,000	+ 1,900
„ United States	—	1,000	+ 1,000
„ Denmark	—	1,000	+ 1,000
„ Germany	520	—	− 520
Batteries, secondary.—			
Total	1,000	1,000	—
From Great Britain	300	200	− 100
„ United States	400	200	− 200
„ Sweden	—	500	+ 500
Heating and cooking apparatus.—			
From Great Britain	400	150	− 250
Insulators, porcelain.—			
Total	4,000	6,000	+ 2,000
From Great Britain	4,000	2,000	− 2,000
„ United States	—	4,000	+ 4,000
Motors and parts.—			
Total	8,000	1,000	− 7,000
From Great Britain	8,000	400	− 7,600
„ Denmark	—	600	+ 600
Electrical cable and wire.—			
Total	30,000	174,000	+144,000
From Great Britain	17,000	166,000	+149,000
„ United States	6,000	2,000	− 4,000
„ Canada	6,000	6,000	—
„ Germany	1,000	—	− 1,000
Telegraph and telephone material.—			
Total	151,000	122,000	− 29,000
From Great Britain	89,000	82,000	− 7,000
„ United States	9,000	13,000	+ 4,000
„ Sweden	50,000	27,000	− 23,000
Electrical machinery, other.—			
Total	5,000	11,000	+ 6,000
From Great Britain	4,000	11,000	+ 7,000
Electrical material, other.—			
Total	6,000	239,000	+233,000
From Great Britain	5,000	190,000	+185,000
„ United States	1,000	47,000	+ 46,000

* Not previously specified.

Turbo-Generator Tests at Bristol.

OFFICIAL tests were recently taken on No. 15 machine installed at Feeder Road power station, Bristol. The set is rated at 7,000 kW, and runs at 3,000 r.p.m. The turbine is designed for the following steam conditions:—

Pressure at the stop valve—200 lb./sq.in.g.
Superheat—190 deg. F.
Vacuum at 7,000 kW—28.63 in. (Barometer 30 in.).

The alternator is a 3-phase machine generating at 50 cycles and 6,000 to 6,600 volts. The set was supplied by the Metropolitan-Vickers Electrical Co., Ltd., and is of special interest in that the turbine incorporates the multi-exhaust stages which are the firm's speciality.

The guarantees are as follows:—

Rating.	Load on Generator.	Steam Consumption.	Vacuum.
100%	7,000 kW	11.30 lb./kWh	28.63 in.
80%	5,600 kW	11.23 ,,	28.75 in.
60%	4,200 kW	11.46 ,,	28.87 in.
40%	2,800 kW	12.12 ,,	28.93 in.

By contract, the average consumption is calculated as follows:—

2×100% maximum continuous rating consumption.
Plus 2× 80% ,, ,, ,, ,,
Plus 2× 60% ,, ,, ,, ,,
Plus 1× 40% ,, ,, ,, ,,

The sum of the above to be divided by 7, giving an average guarantee consumption of 11.44 lb./kWh.

The results obtained on the official tests were as follows:—

Load on set (nominal).	100%.	80%.	60%.	40%
Stop-valve pressure, lb./sq. in. g.	186·5	196·6	188·9	194·9
,, temperature, deg. F.	548·0	558·3	537·5	544·2
,, superheat	165·6	171·8	164·1	158·3
Var. at exhaust flange (barometer 30"), Hg.	28·602	28·778	28·853	28·967
Net condensate, lb /hr.	82,141	68,289	53,400	39,249
,, load, kW	7,134	6,089	4,634	3,274
Consumption as run, lb./kWh	11·514	11·207	11·524	11·986
Correction for S.V. pressure, %	−1·00	−0·24	−0·85	−0·40
,, ,, ,, superheat, %	−2·05	−1·55	−3·00	−2·65
,, ,, vacuum, %	−0·15	−0·20	−0·13	−0·60
Total correction, %	−3·20	−1·60	−3·98	−3·45
Corrected consumption, lb./kWh	11·144	11·021	11·064	11·696
Average consumption ,, ...	(Test) 11·165			
,, ,, ,, ...	(Guar.) 11·440			

The actual consumption of the machine was, therefore, better than guarantee by 0.275 lb./kWh, or 2.4 per cent.

The tests were carried out under the supervision of Mr. A. J. Newman, deputy engineer, and have been approved by Mr. H. Faraday Proctor, chief engineer and general manager of the Electricity Department, Bristol.

Duplicate power measurements were taken by polyphase integrating wattmeters, which were calibrated by the Manchester School of Technology both before and after the test. These calibrations agreed within 0.21 per cent. During the tests, the power indications of the two meters agreed within 0.23 per cent.

The steam pressure gauges were calibrated by a dead-weight test before and after the tests. The high-reading thermometers used for measuring steam temperature were calibrated before and after the tests.

The vacuum was maintained very closely to the guaranteed vacuum in order to minimise corrections, and was measured at two points at the exhaust flange, both of which agreed very closely.

The barometer readings were taken on a calibrated aneroid barometer, and checked against the station mercury barometer.

Water was measured in tanks calibrated throughout their range before the tests.

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Pulverised Coal.

Considerable controversy seems to be taking place over that much discussed question: "What becomes of the ash from pulverised fuel?" It is a generally recognised fact that the stack of any steam station when operating at any rating at all delivers *débris* to the atmosphere. The point that has been grossly exaggerated, however, is that the *débris* discharged from a pulverised fuel plant is much greater in magnitude and more destructive to property and to the general health of the community. The statement that the *major* portion of the non-combustible in the fuel passes up the stack is absurd. The only fully authenticated data that have come to my notice are those of the U.S. Bureau of Mines. Taking 30 continuous tests under varying load conditions, they show an average of 29.5 per cent. of ash unaccounted for—assuming the coal to contain 10 per cent. ash this reduces to 2.9 per cent. of coal fired, which is about the same as for other methods of firing.

It has been stated by Mr. Wylde that the deposit of ash takes place anywhere within 1,000 yards' radius. Despite the endeavours of very earnest investigators, however, none has been found, but an example will prove the absurdity of Mr. Wylde's statement.

The Lakeside Station of the Milwaukee Electric Railway and Light Co. with which many English engineers are conversant, has eight boilers of 13,060 sq. ft. Assuming these to be operating at 200 per cent. of their rating, about 41 tons of coal per hour would be consumed. On the 10 per cent. ash basis, 98.4 tons of ash would be formed per 24 hours. Assuming that 30 per cent. goes up the stack, 29.5 tons would be deposited in the 1,000 yards' radius every 24 hours. That is, assuming an even distribution throughout the area, about .02 lb. per sq. yard every 24 hours, which is absurd.

Now what is the nature of this *débris*? Analysis will show it to be about 80 per cent. silica, 10 per cent. alumina, and the remainder iron, lime, and magnesia, and *no* discolouring matter. When it eventually comes down it is in the form of an earthy substance containing no soot or tarry matter.

Now let us study the size of the particles. When fired 60 per cent. runs from .008 to .0024 in. in diameter, but only 10 per cent. of this is ash, hence in size the particles passing up the stack must be infinitesimal, and further, as a study of the particles when separated and isolated under the ultra-microscope shows them to be never stable, it may be assumed that none but the heaviest of them fall to earth until they are precipitated by moisture.

Many engineers are devoting time to this "ash problem," which is not a problem in any pulverised fuel plant so far constructed, and many of the statements made are contrary to the experience of the operating engineer. Many engineers would profit by referring to the transactions of the engineering societies of other countries, particularly the A.S.M.E., as it must be remembered that pulverised fuel has been employed for 12 or 14 years at least.

Referring to the letter in your issue of June 6th, in which Mr. Erith assumes that I have been mistaken as regards the progress of pulverised fuel and stokers, I should like to advise to the contrary. I am well aware of the additions made to the stoker equipment in the plant enumerated by Mr. Erith, and I must say that in these cases, and probably many more, the installation of stokers in preference to pulverised fuel is the correct practice. I never have upheld the indiscriminate use of either system—each has its particular field of application, and when removed therefrom will be under a severe handicap if operating in competition with the more adaptable system. In substantiation of my statement that pulverising equipment is making great progress in the combustion field, I could quote many stations, some operating entirely on pulverised coal—others installing pulverised coal apparatus in extension of their present stoker-fired plant. Space, however, limits one to a few typical examples:—

Lakeside (designed 1919) ... 8 boilers of 13,060 sq. ft.
Cahokia (designed 1922) ... ... 8 boilers of 18,010 sq. ft.
River Rouge (Ford's plant), 1922 4 boilers of 20,470 sq. ft.
Trenton Channel (1923) ... ... 6 boilers of 29,000 sq. ft.
Peoria (under construction) ... 4 boilers of 13,920 sq. ft.

Colfax, 13 of 20,876, and 6 of 27,068, is installing pulverised coal equipment for 5 of the new boilers.

The ultimate aim in any plant is the production of cheap steam. Steam cost embraces capital charges, fuel cost, efficiency of operation, labour, and maintenance. When a plant is designed, the kind of coal that is to be used will influence the selection of the equipment and have a bearing on the capital investment as well as the steam production.

Now let us deal with the conditions under which the coal is secured. As far as the railway or cartage company is concerned, one ton of coal is merely one ton of coal, and whether the grade be good, bad, or indifferent, the freight is just the same. To the engineer, however, one ton of coal represents so many B.th.u., and, although cheaper at the pit, low-grade coal will be the more expensive at the end of a long journey. To get the B.th.u. as cheaply as possible, the grade of coal most suitable must be worked out on this basis, keeping in mind the efficiency at which the most efficient combustion apparatus will operate—capital investment considered as well, of course.

It is generally admitted that with high-grade bituminous coal of low ash and sulphur content pulverisation holds no practical advantages, and the first cost is higher—under these conditions, *i.e.*, where it pays to use high-grade coal, stokers should invariably be used. Most of the plant quoted by Mr. Erith belongs to the New York group; the nearest coal field is high-grade bituminous, the low-grade fields being much more distant, hence it is obvious why plant in this particular locality has not adopted pulverised fuel. Generalising then, we may say that pulverised coal equipment predominates near the coal fields, particularly if the grade of coal is low and contains a high percentage of low-temperature fusing ash, and is high in sulphur. At points distant from a coal field stoker plant will generally predominate. Each plant, however, presents a separate economic problem, and it is only after a careful study of all the factors that one can determine whether pulverised fuel equipment has sufficient advantages over stokers to warrant its installation.

Now, dealing with the Hell Gate test, the stoker employed was one of the ordinary Taylor multiple retort type—very good stokers, and probably as near perfection as several other well-known types. There are many of them in use, but they do not seem capable of putting up such a spectacular performance under their respective boilers as this one. I venture

to suggest that it may be the boiler and furnace that deserve the credit, and that any other high-class retort stoker under it would give as high results. The radical departure in design applies to the boiler with its so-called fin furnace, and not to the stoker, and just why the stoker should be given *all* the credit is not at all clear. Neither do I see how these test results can be quoted against pulverised coal before it has been tried out under this type of boiler and furnace.

Further, it is generally admitted that the rate of deflagration and burning with pulverised coal is exceptionally high; it is probably higher, and certainly no lower, than the rate of burning of the volatile constituents above the fire bed in the ordinary furnace. If a given rating can be secured on a boiler with gases produced from such a fire bed, what reason is there to suppose that the same rating cannot be secured with similar gases resulting from the same coal in pulverised form?

Jas. F. Edgell.

Maldon, *July 7th*, 1924.

Protection Against Pressure Rises.

We, no doubt like many of your readers, were interested in your editorial comments on the article by Mr. G. W. Partridge on the above subject, and we were very much gratified to find that the author recommended the use of apparatus designed on very similar lines to that which we have been manufacturing for the last 26 years, with improvements in detail up to the present time.

It has often been a matter of surprise to us that this class of apparatus has not been more largely adopted in distribution systems, where the plant has not been designed to withstand the pressure rises met with in practice.

It may, however, be of interest to your readers to point out that the provision of protecting apparatus has undergone quite a series of evolutions in the minds of power engineers during the last few years, as the result of many years' practical experience in line service. The outcome of this goes to prove that the best protection is *no* protection, discarding the use of all protecting apparatus and choke coils. This, however, means that the windings of the transformers must be puncture-proof against high-frequency waves, which manufacturers can now guarantee.

It is naturally to our interest on the one hand as manufacturers, to sell surge protecting apparatus, but our first consideration is to accommodate our ideas, in the interests of the industry as a whole, to the requirements of actual practice.

For further information on this subject we would refer your readers to an article appearing in the *Bulletin* of June, 1923, of the Association Suisse des Electriciens.

Sprecher & Schuh Co.,
J. B. RUDKIN.

London, *June 30th*, 1924.

Small Power Stations.

I have on several occasions written under the above heading on the prospects and advantages of small towns and villages adopting their own electricity undertakings. I am fully aware that quite a number of such undertakings are in debt; in fact, I saw in your last issue that "Annfield Plain"—a small township—is in debt to the extent of £1,527, or, I should say, has made a loss of that amount.

These statistics, I am afraid, will deter many public-spirited men from risking such undertakings. I have received a number of private communications on my recent articles, and am quite convinced that the secret of failure or success depends entirely on two things: first, the amount of capital expended in the undertaking, and secondly, by the overhead charges after the station is in commission.

I am at the moment running a small station of 20-kW, which I myself installed. We have only 50 consumers, yet we have not even in the first year made a loss, and our small profits are continually increasing. As a pioneer of small stations, I shall be glad to advise anyone interested, either in conjunction with or in opposition to gas companies. I can make out a good case for electricity from a village of 100 consumers up to 1,000 kW.

C. Wood.

Newcastleton Electricity Works,
June 30th, 1924.

A Critic Comes Home: A Breezy Review.

I have recently returned to this country from China (through Japan and America) after an absence of 14 years—an absence broken only by war service. I have been surprised at the comparatively small developments that have taken place in things electrical in this country as compared with other countries, particularly America. I find that there are whole townships that still do not know the advantages of electricity; for instance, I saw a town in the North that has to-day no public supply, although half its population is engaged in the manufacture of accumulators.

In North Wales I noticed expensive coal being carted on the mountain roads to within a hundred yards of a transmission line from which electricity ought to be available at not more than ½d. a unit, for cooking and heating purposes. I see *oil* lamps burning at a railway station not 20 miles from London.

I understand that in Chicago the consumption of electricity is about 1,000 units *per capita* per annum, as compared with the best figure of 200 units in this country. What is the cause of this enormous difference? For it is undeniable that there is a difference.

I have been given a number of reasons for our backwardness, and every reason, or apology, has been different. My own personal view is that the electrical engineers of the country are themselves individually to blame, in that they have been lacking in a spirit of belief in the possibilities of electricity. The result is that engineers (both supply and manufacturing) have not adopted electricity in *their own homes*, and if a man has not sufficient belief in his own manufacture to use it himself he cannot have sufficient faith to advertise confidently to the outside world.

Is it not a disgrace that about the only electrical advertising that is done in England is that of Singer sewing machines? I long to see the front page of the *Daily* —— with a "Do it Electrically" advertisement, and I respectfully submit that various British firms should combine for such an advertisement, instead of the expensive and non-profitable patent litigation "slanging" that is going on at present. I suggest, also, that every engineer-in-charge should endeavour (I know it is difficult to convince committees!) to obtain at least 1 per cent. of his revenue for sales "boosting."

There are in the country a few enthusiasts on electrical development—as at Hackney, Shoreditch, and Glasgow.

I know that, from a high technical point of view, we are not behind America, but we are decidedly so in the applications of electricity, whether it is in the drive of a battleship or a lady's hair-curler.

A glance at the pages of *Electrical Merchandising* will show that there is a distinct phase lag between this country and America. There are numbers of electrical appliances that should be in common use in this country, such as washing machines (not the old-fashioned "mangle"), bread-baking machines of the rotary type, and household refrigerators (I have at last found a small refrigerator in Wembley—in the Tropical Diseases Section!).

These articles *would* get into use if every consumer in the country were supplied with a copy each month of *The Home Electrical*, and perhaps the REVIEW and its colleagues, or the E.D.A., will see their way clear to publish such a magazine as a combined effort.

Another complaint that has been made to me is the difficulty of persuading some supply authorities to connect houses that are a few yards away from their mains and the high cost of "juice." I recently made inquiries about a number of small new villas that have been built only 20 miles from London. Although electricity was available in the district, it was not laid on to the houses, and I was informed that the reason was that the cost of the cables was too great, and that, in any case, electricity would be charged for at 12d. per unit (since reduced to 10d.).

I submit that any authority that cannot supply at less than 6d. as an average for lighting should give way to a more efficient organisation that can do so.

I suggest also that the retail cost of domestic electrical appliances is too high, and such that it prevents their extensive use. To-day electricity meters can be purchased for about 25*s.* each, and electric kettles are retailed at 30*s.* to 35*s.*, which is surely too high when one considers the complication of the meter as compared with the simplicity of the kettle or the electric iron.

If the price of appliances could be lowered, the consumption of electricity would be increased and the load factor improved.

I am very interested in electric battery cars and lorries as valuable load builders for central stations, and I anticipated that the industry would have a good show of them at Wembley, but none are to be found in the Exhibition with the exception of the "creepy-crawlies" in the grounds. If the battery car is not an economical proposition it should be dropped entirely, but if it is—then why not push it?

Finally, I would appeal to our electrical engineers for more belief in the possibilities of electricity in their own domestic lives, and infinitely more enthusiasm and more advertising; the result will be increased generation, lower prices, increased manufacture, and more employment for all.

If we have faith in electricity we can remove mountains (a small job!), electrify railways (a bigger contract, but which only requires a standard system), and even induce some of the supply companies to give free house services!

R. A. Williams.

July 1st, 1924.

The Temperature Rise of Electrical Machinery.

I am greatly interested in the solution given by Mr. T. W. Rowlands for determining the final temperature rise. It is the simplest I have seen. Also, it enables the heating time factor to be calculated thus:—

$$\tau_0 = t_1/\log_e [x_1/(x_2-x_1)].$$

It is seldom realised, however, that the value of τ_0 calculated from test results on field windings is a function of the temperature rise and is therefore not a "constant" for a given machine. This point is fully dealt with in a paper that will probably appear in the next *Journal* of the Institution of Electrical Engineers.

From time to time, various people suggest the application of the exponential heating equation for calculation of the final

temperature rise from the results of a short heat run. Unfortunately there is a number of difficulties:—

(*a*) The actual heating curve may depart appreciably from the exponential curve, the shape of the actual curve being influenced by the speed and by the losses in other parts of the machine.

(*b*) It is impossible to obtain satisfactory thermometer readings after periods t_1 and t_2. Only the stationary parts are accessible; the thermometer bulb must be protected; and the temperature distribution in a coal varies during a test. With the voltammeter method, it is extremely difficult to obtain reliable results, especially if only three sets of readings are noted. Much greater accuracy, however, can be obtained by an arrangement described in the paper referred to above.

(*c*) Even if the temperature of the field winding be satisfactorily determined, there still remains the temperature rise of the armature. It is out of the question to stop the machine sufficiently long for a thermometer reading to be taken; and resistance measurement is seldom satisfactory, especially for a d.c. armature.

I have applied Mr. Rowlands's solution to several curves of temperature rise taken recently on a protected-type 3-phase alternator. Only the field temperatures are considered, and the values have been corrected for any variation of air temperature.

	Test 1.	*Test* 2.	*Test* 3.
Final temp. rise by test, deg. C. ...	19.5	42	50
Findl temp. rise calculated for t_1 of			
20 minutes	16.9	29.2	42.8
Ditto for t_1 of 40 minutes	17.8	33.3	46.2
Ditto for t_1 of 80 minutes	18.9	36.0	48.6

The above results are typical of a large number and are sufficient to show that the final temperature rise calculated from a test of short duration is generally 10 to 30 per cent. lower than the actual value, and consequently is not likely to be regarded as satisfactory.

Up to the present I have not been able to find a single reliable method of shortening the heating test. An initial overload may save a little time, but the method is liable to be deceptive.

Edward Hughes.

Technical College, Brighton.
July 5th, 1924.

Specifications for Electrical Plant.

As an old reader of your valued paper, I should be obliged if any of your numerous readers could, through your columns, enlighten me as to any work or handbook comprising the drawing-up of specifications of both the outside and inside branches of a modern power supply authority.

Inquiry.

A Modern Electric Flat.

With reference to Mr. Robinson's reply in your issue of June 20th to my letter appearing in the same issue, Mr. Robinson implies:—

(*a*) That the case he puts is not a special one, but is based on the tariff generally applicable in Hackney.

(*b*) That the "substantial surpluses—made by the Hackney undertaking" are obtained on these admittedly low charges.

Mr. Robinson's whole case and the value of his various comments depend therefore upon the accuracy of the above statements.

These statements can be tested by reference to the Hackney returns as published in the *Electrical Times* tables, as we are entitled to assume that these tables are reasonably correct.

Statement (*a*)—

The case put by Mr. Robinson shows

1,310 units sold for £5 8s. 4½d., equivalent to an average price of .99*d. per unit* approx.

The *Electrical Times* tables show that the average price charged in Hackney for "private supply" purposes during year ended March, 1923, was 2.63d. *per unit*.

This does not appear to confirm that the case as cited by Mr. Robinson is a general one.

Statement (*b*)—

Again referring to the *Electrical Times* tables, we find:—

Units sold in Hackney (for private supply purposes) per head of population = 57.1.

Population of Hackney = 222,100.

i.e., total units sold for private supply purposes = 12,681,910 units.

If these units had been sold at an average price of .99d. per unit instead of at 2.63d. per unit there would have been a difference in gross revenue at the rate of 1.64d. per unit.

Reduction in gross revenue would therefore have been:—
12,681,910 units at 1.64d. = £86,660.

The "substantial surplus" to which Mr. Robinson refers amounted in 1923 to £22,868.

It is evident therefore that if the case cited by Mr. Robinson were general in application the undertaking would have sustained a "most serious financial loss" in place of showing a "substantial surplus."

Note.—It is of interest to note that the average price per unit, as shown in the case put by me works out at

1,340 units for £13 4s. 10½d.
i.e., 2.37*d.* per unit.

It will be agreed that this is somewhat less than the actual *average price* charged by Mr. Robinson's undertaking.

I am now informed that the charge for heating in Beeston is 1¾d. per unit, which will make the average charges here substantially better than the average charges in Hackney.

R. C. Woods.

Beeston, *July 3rd*, 1924.

I am quite amused at the ingenuous way in which Mr. R. C. Woods tries to prove that the Hackney electricity undertaking is either a failure or is doomed to failure.

He falls into the old error which has caught so many people of trying to deal with averages in the cost of electricity without having any regard to the conditions under which the electricity is supplied.

Can he not see that when everybody has an all-electric home the average price the private consumers will have to pay will certainly fall to somewhere near a penny per unit or less?—because the circumstances will be entirely dissimilar from the circumstances existing to-day in virtue of the fact that the quantity, diversity, and load factor will all have improved enormously.

L. L. Robinson,
Borough Electrical Engineer.

Electricity Works, Hackney.
July 7th, 1924.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

34,053. "Increasing the efficiency of dynamos and electric motors." G. H. Tatham and J. R. Pullon. December 13th, 1922. (217,253.)

34,653. "Automatic or semi-automatic telephone exchanges." G. H. Janson. December 20th, 1921. (190,730.)

1923.

370. "Thermionic valves." British Thomson-Houston Co., Ltd., and J. Gray. January 4th, 1923. (217,256.)

940. "Receiving apparatus for wireless telegraphy and telephony." D. S. B. Shannon. January 11th, 1923. (Cognate application, 8,254/23.) (217,259.)

3,558. "Wireless telegraph receiving apparatus." R. P. Richardson, T. M. Cole, and G. L. Ward. February 6th, 1923. (217,267.)

3,654. "Electrically-illuminated advertising signs or the like." E. V. Hayes-Gratze. February 7th, 1923. (217,268.)

3,655. "Luminous electric signs and devices." E. V. Hayes-Gratze. February 7th, 1923. (217,269.)

4,040. "Method of, or apparatus for eliminating the disturbances caused by the ignition systems pertaining to explosion motors in the reception of wireless signals or messages." V. Kulebakin. February 10th, 1923. (217,270.)

4,142. "Electric condenser." E. Pfiffner. February 10th, 1922. (193,669.)

4,355. "Vacuum electric tubes." E. Y. Robinson. February 14th, 1923. (217,273.)

5,598. "Resonators, amplifiers, horns, and like apparatus for the emission of sounds." G. Harrison (A. Barberis). February 25th, 1923. (217,276.)

6,721. "Electrical switchgear." T. C. Christianson and Metropolitan-Vickers Electrical Co., Ltd. March 8th, 1923. (217,290.)

7,047. "Method of forming bonds for permanent way of electric rail or tramways." E. Clark. March 12th ,1923. (217,303.)

7,109. "Plate construction for electric accumulator cells." L. Murphy. March 12th, 1923. (217,306.)

7,295. "Dynamo-electric machines." Soc. Anon. "Electrolabor." March 13th, 1922. (194,731.)

7,398. "Dynamo-electric machinery, transformers, and the like." Sir C. A. Parsons and J. Rosen. March 14th, 1923. (217,320.)

7,515. "Vacuum electric tubes." E. Y. Robinson. March 15th, 1923. (217,327.)

7,610. "Thermionic valves for wireless telegraphy and telephony." W. Kimpton. March 16th, 1923. (217,329.)

7,733. "Means for the automatic control of electric machines." English Electric Co., Ltd., and R. A. R. Bolton. March 17th, 1923. (217,333.)

7,826. "Means for connecting several wires to one electrical contact." P. D. Morton. March 19th, 1923. (217,338.)

8,016. "Electric transmission systems." A. M. Taylor. March 21st, 1923. (Cognate application, 14,313/23.) (Addition to 170,619, as modified by 183,339.) (217,342.)

8,020. "Aerials for receiving wireless signals." B. Bryan. March 21st, 1923. (217,344.)

8,245. "Electric coupling arrangements." A. L. Davis. March 22nd, 1923. (217,347.)

9,616. "Electrical variable condensers." C. E. Raeburn and W. E. Taylor. April 9th, 1923. (217,370.)

10,963. "Electric radiators." G. H. Ide and G. S. Cattell. April 23rd, 1923. (217,381.)

12,461. "Electric distribution systems and switches therefor." N. Togami. May 9th, 1923. (217,396.)

12,859. "Electric resistance control devices." H. J. Wiegand. May 15th, 1922. (197,697.)

13,671. "Wireless receiving circuits." P. G. A. H. Voigt. May 23rd, 1923. (217,409.)

14,045. "Electrolytic processes." W. J. Mellersh-Jackson (Mathieson Alkali Works, Inc.). May 28th, 1923. (217,414.)

14,948. "Automatic reclosing circuit breaker systems." British Thomson-Houston Co., Ltd. (General Electric Co.). June 7th, 1923. (217,417.)

14,949. "Electric measuring instruments and method of using the same." British Thomson-Houston Co., Ltd. (General Electric Co.). June 7th, 1923. (217,418.)

15,088. "Telephone systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. June 9th, 1923. (217,419.)

17,748. "Short-circuited rotors for asynchronous electric motors." J. Rezelman. July 9th, 9123. (217,443.)

20,594. "Electric batteries." K. Katsumori. August 13th, 1923. (217,465.)

22,027. "Means for the distant automatic control of a central electric hydraulic station." M. Lorfeuvre. September 7th, 1922. (203,682.)

23,592. "Trolleys for collecting electricity." R. Mahon and T. Corcoran. September 21st, 1923. (217,479.)

25,467. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). October 12th, 1923. (217,490.)

25,718. "Electric steam generating plants, particularly for locomotives." D. Mottura. October 15th, 1923. (217,492.)

28,159. "Means for the protection of dynamo-electric machines." Siemens and Halske Akt. Ges. November 8th, 1922. (206,844.)

32,490. "Machines for manufacturing stems for electric lamps." Naamlooze Vennootschap Philips Gloeilampenfabrieken. July 19th, 1923. (217,519.)